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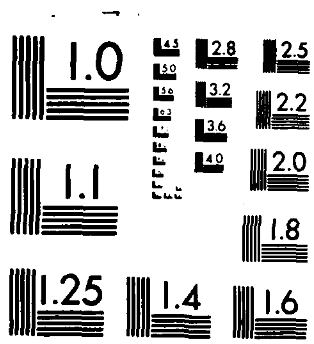

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SURVEY, TESTING, AND DOCUMENTATION
ASSEMBLY AND OFFENSE AREAS
LIVE FIRE MANEUVER RANGE
FORT IRWIN
SAN BERNARDINO COUNTY, CALIFORNIA

Prepared for:

U.S. Department of the Interior
National Park Service
Interagency Archeological Services Division
San Francisco
450 Golden Gate Avenue, Box 36063
San Francisco, California 94102

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Principal Investigators

William T. Eckhardt M. Jay Hatley

June 1982

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16. Abstract (Limit: 200 words)

Extensive field research was conducted to identify and evaluate the cultural resource inventory for eligibility for inclusion in the National Register of Historic Places. Analysis and report documentation began in April 1981 and continued through April 1982, culminating in determinations of resource significance and recommendations. The study area consisted of 4,308 acres in three discontinuous locations planned for construction or use in conjunction with live fire training maneuvers at Fort Irwin. Intensive pedestrian survey of 2,718 acreas culminated in examination of twenty-one cultural resource sites and sixty-seven isolated finds, ranging from extensive prehistoric deposits of flaked stone artifacts and activity features to smaller activity sites, isolated finds, and historic mining claim markers. The additional documentation, recording, and collection of data was undertaken on four extensive resource sites totaling 1,590 acres. Of the cultural resource sites examined, sixteen appear to meet criteria for inclusion in the National Register of Historic Places: 4-SBr-4204, 4249, 4515, 4729, 4730, 4732, 4733, 4734, 4735, 4736, 4744, 4746, 4749, and 4751. Three sites, SBr-4204, 4249 and 4515, comprise a significant lithic resource procurement area and recommendations are made for a district designation for the National Register. A preliminary analysis is made of cores and blades from these resources with replicative studies and refitting included.

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ABSTRACT

Cornerstone Research conducted extensive field research within the proposed Live Fire Maneuver Range Assembly and Offense areas at Fort Irwin, San Bernardino County, California. Investigation was performed in compliance with the National Historic Preservation Act (Public Law 89-665, Executive Order No. 11593, and 36 CFR 60.4 under the auspice of the U.S. Department of Interior, National Park Service, Interagency Archeological Services Division. Project funding was provided by the U.S. Department of the Army, National Training Center. Principal Investigators for the project were Mr. W.T. Eckhardt and Mr. M.J. Hatley. The purpose of the research was to identify and evaluate the cultural resource inventory for eligibility for inclusion in the National Register of Historic Places.

The study included intensive pedestrian survey and additional documentation, recording, and collection of data from culturally sensitive regions previously surveyed (Davis, Eckhardt and Hatley 1981; Hanna et al. 1981). Fieldwork was conducted between April 9 and June 15, 1981. Analysis and report documentation commenced in April 1981 and continued through April 1982, culminating in determinations of resource significance and recommendations, as presented in the following report.

The study area consisted of 4,308 acres in three discontinuous locations planned for construction or use in conjunction with live fire training maneuvers. Intensive pedestrian survey of 2,718 acres culminated in examination of twenty-one cultural resource sites and sixty-seven isolated finds, ranging from extensive prehistoric deposits of flaked stone artifacts and activity features to smaller activity sites, isolated finds, and historic mining claim markers. The additional documentation, recording, and collection of data was undertaken on four extensive resource sites totaling 1,590 acres. Of the cultural resource sites examined, sixteen appear to meet criteria for inclusion in the National Register of Historic Places: 4-SBr-4204, -4249, -4515, -4729, -4730, -4732, -4733, -4734, -4735, -4736, -4744, -4746, -4749, and -4751.

ACKNOWLEDGEMENTS

With the completion of the many tasks and aspects of this examination, the time has come to recognize the support and services of numerous individuals who have brought this research to a fait accompli. Notably, our heartfelt appreciation goes to Dr. Emma Lou Davis, Great Basin Foundation, for her irascible tutelage and inestimable advice and counsel, truly making this effort a valuable learning experience for all.

For logistical support and liaison between Cornerstone and U.S. Army, Forces Command, we wish to thank Lieutenant Colonel Harvey Walker (USA, retired) and the Division and Facilities Engineering staff, National Training Center, for their considerable involvement and close support which allowed successful completion of the field aspects of this research.

In regard to the detailed field effort required of this examination, we extend our thanks to the Cornerstone field crews and to A.R.T. Maps, Inc., who endured the sweltering weather and tight schedules to procure meaningful information from the resource sites subjected to inspection. For their extraordinary efforts, we particularly wish to acknowledge Ms. Fran Buck, Butch and Ginger Hancock, Mr. Jim McManus, and Mr. Joe Vogel who, collectively and individually, saw past the day-to-day discomforts and recognized the importance and value of the total research program.

Invaluable counsel and geomorphic assessment was provided by Dr. Roy Shlemon, R.J. Shlemon and Associates, Inc. Although limited to cursory field reconnaissance and disallowed major field techniques for discovery and interpretation, Dr. Shlemon performed superbly and provided significant insight to landforms, features, and paleo-climatic conditions affecting the deposit and subsequent condition of the resources under inspection.

Special thanks goes to Dr. Gerald Smith and the staff of the San Bernardino County Museum Association. The opportunity to review collections, notes, and records from this repository was openly provided and anxiously received, as a thorough examination could not be performed without benefit of existing information recovered previously from the northwestern Mojave Desert region.

Analysis of the flaked stone refuse and performance of replicative experimentation was enhanced tremendously by the participation of Mr. Rod Reiner and Ms. Lisa Roe. Mr. Reiner, a San Diego-based stoneknapper, assisted greatly in this research and continues to supply Cornerstone with extensive data on flaked stone technologies and replicative studies, an absolute necessity to synthesize the volume of data generated by the documentation and recording procedures employed in this study.

As with most projects of this caliber, office staff and production personnel formed the backbone of this investigation. Appreciation is due to Mr. Joe Vogel, who labored endlessly in the synthesis and preparation of locational data, maps, and figures. We especially wish to thank Ms. Nancy Hatley for her extensive technical expertise and unique interest in generating a complete, correct, and readable manuscript. Gratitude is also extended to Dr. Daniel Whitney, San Diego State University, for his achievement of a comprehensive scholarly review of this document and preparation of extensive editorial commentary. Nonetheless, any omissions or errors in the reporting of this endeavor are the sole responsibility of the Principal Investigators.

Finally, we wish to thank our spouses, families, and friends who endured the months of hardship, preoccupation, and neglect while these data were worked into a meaningful document. To these kindred spirits, we remain forever in debt.

William T. Eckhardt

M. Jay Hatley

Cornerstone Research

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SECTION I

INTRODUCTION

In compliance with the National Historic Preservation Act (Public Law 89-665, as amended), Executive Order 11593, and 36 CFR 800, Interagency Archeological Services Division-San Francisco contracted with Cornerstone Research for an intensive archaeological study of select portions of two major training ranges at the National Training Center, Fort Irwin, California. The study included intensive pedestrian survey, additional documentation, recording, and collection of data from culturally sensitive regions surveyed previously (Davis, Eckhardt and Hatley 1981; Hanna et al. 1981). The United States Army, National Training Center, provided funds to the National Park Service to carry out the study. Fieldwork was conducted between April 9 and June 15, 1981. Analysis and report documentation commenced in April 1981 and continued through April 1982, culminating in the determinations of resource significance and recommendations presented in this report.

Results of the study were positive; previously unrecorded cultural resource sites were observed and inspected in the Silver Lake Road region and in the southwest corner of the military reservation. Additional documentation was obtained for previously recorded resource sites in the northeast quarters of the military reservation. One hundred eight cultural resources were discovered, located, and recorded. Thirty-three of them were designated sites and the rest noted as isolated finds. Four previously reported sites were studied in detail to provide additional information useful in determining their eligibility for inclusion in the National Register of Historic Places (Davis, Eckhardt and Hatley 1981; Hanna et al. 1981). These resources and recommendations for their disposition are the subject of this report.

PROJECT SETTING

Fort Irwin, a military reservation 643,000 acres in size, was originally withdrawn from Public Lands by the United States Army in 1952. The reservation is situated in the Mojave Desert, thirty-five miles northeast of Barstow, California, and nineteen miles west of Baker, San Bernardino County, California (Figure 1). During its military history, the fort has variously been under the command of Reserve and Regular Army forces, although it has been under the direct jurisdiction of the Secretary of Defense since its withdrawal. On July 1, 1981, Fort Irwin was reactivated as the primary National Training Center (NTC) for the United States Army, Forces Command (FORSCOM).

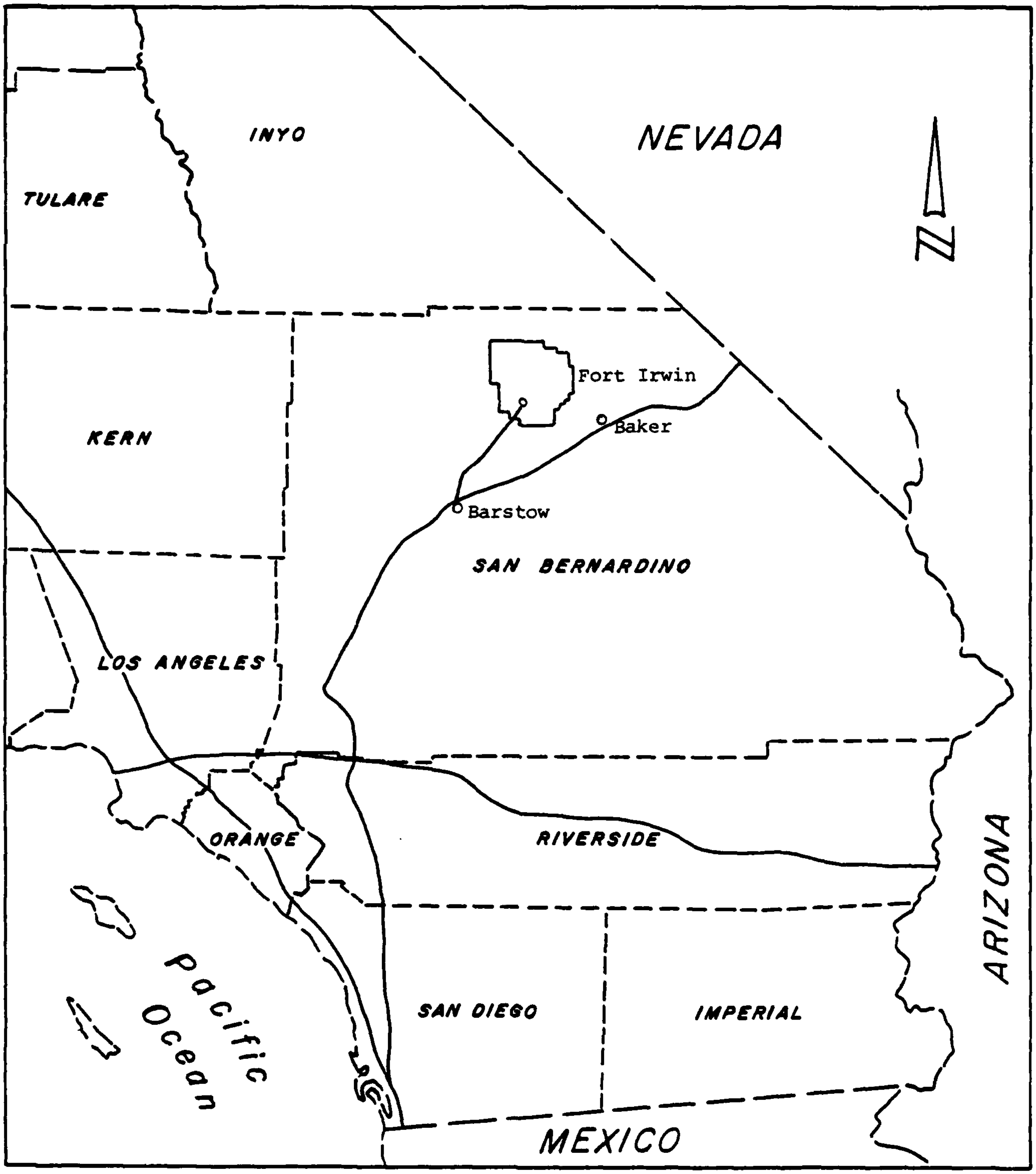


Figure 1

This map of southern California illustrates the approximate location of the Fort Irwin Military Reservation in relation to Barstow and Baker, California, and within the County of San Bernardino.

A full-scale cultural resource management program for the NTC was recently initiated. At the present time, however, no comprehensive inventory or adequate assessment of most cultural resources within the reservation has been completed. Instead, large-scale military projects and training exercises conducted by Regular Army and Reserve forces have been preceded by assessment for potential adverse impacts to resources in those select portions of the reservation scheduled for activity (Alsoszatei-Petheo 1978; Kaldenberg 1978, 1980a, 1980b; Davis, Eckhardt and Hatley 1980, 1981; Bull 1980; Hanna et al. 1981).

Interagency Archeological Services Division (IAS), National Park Service, is currently assisting the United States Army, National Training Center (NTC), to comply with historic resource preservation legislation and regulations. Legal mandate for this compliance arose when the Fort Irwin Military Reservation was being transformed into a major desert warfare training installation. Operations in the several major maneuver zones will place tank targets, support facilities, assembly zones, and maneuver areas for live fire, instrument, and opposing force training tactics throughout the reservation. Recent cultural resource surveys of the Live Fire Maneuver Range (LFMR) zone (Davis, Eckhardt and Hatley 1980, 1981; Bull 1980; Hanna et al. 1981) have identified numerous prehistoric cultural resource sites, interpreted as representative of at least 12,000 years of human activity in this region.

Construction and successful operation of the training ranges cause unavoidable adverse impacts which may damage or destroy cultural resources in the Assembly and Offense areas of the LFMR (Davis, Eckhardt and Hatley 1981:140-148). Interagency Archeological Services Division required additional intensive survey and further documentation, recording, and collection in the Assembly and Offense areas of the LFMR. The purpose was to develop a sensible, efficient data recovery program for resources that might be eligible for inclusion in the National Register of Historic Places. These efforts were requested in the public interest pursuant to Executive Order No. 11593 (Protection and Enhancement of the Cultural Environment), Title 36 CFR 800 (Procedures of the Advisory Council on Historic Preservation for the Protection of Historic and Cultural Properties), the Archaeological and Historic Preservation Act of 1974 (P.L. 93291; 88 Stat. U.S.C. 469), and a Memorandum of Agreement between the Advisory Council on Historic Preservation/State Office of Historic Preservation and the United States Army, National Training Center. The following tasks were required to comply with these mandates:

1) Develop a research design based upon the previous studies and research problems that justifies research strategies and directs the continued and/or future research effort in the region

2) Further define and evaluate the known resource sites in the Assembly (4-SBr-4249 and -4241) and Offense (4-SBr-4204, -4515, -4516, -4520, and -4521) areas and judge whether they meet criteria of eligibility for inclusion in the National Register of Historic Places

3) Locate, define, record, and evaluate any other cultural resources present within the project areas

4) Prepare recommendations to mitigate potential adverse impacts to resources whose sensitivity and significance warrant inclusion in the National Register of Historic Places.

This cultural resource inventory was conducted under the auspices of the U.S. Department of the Interior, National Park Service, Interagency Archeological Services Division-San Francisco, and was funded by the United States Army, National Training Center. Project requirements were spelled out in Purchase Order No. CX 8099-1-0001 (formerly HCRS C52019(81)), with modifications.

Time available to conduct the field aspects of this research program was severely constricted by ongoing tactical training programs scheduled long in advance by the U.S. Army Reserve. These training exercises and the research program were in direct conflict on at least three occasions, necessitating the removal of research teams from Assembly and Offense areas of the LFMR and slowing--in some cases retarding--the total effort by redirecting invaluable time and financial resources away from cultural research. Owing to these limitations, strategic aspects of contract no. CX 8099-1-0001, in concordance with National Park Service representatives, were either dropped from the agreement entirely, substantially modified, or seriously set off track in relation to the contract timetable.

Immediate concern focused on the further evaluation and assessment of four previously reported site areas within the LFMR (4-SBr-4204, -4249, -4515, and -4516) and the location, evaluation, and assessment of additional culturally related materials in either the Silver Lake Road region (LFMR) or the Instrumented Range Assembly Area (IRAA) (Figure 2). To this extent, the following was accomplished:

1) Development of an appropriate strategy and research design

2) Intensive on-foot survey of portions of the Silver Lake Road region and IRAA

3) Description of all located sites and isolates, including official trinomial or San Bernardino County Museum

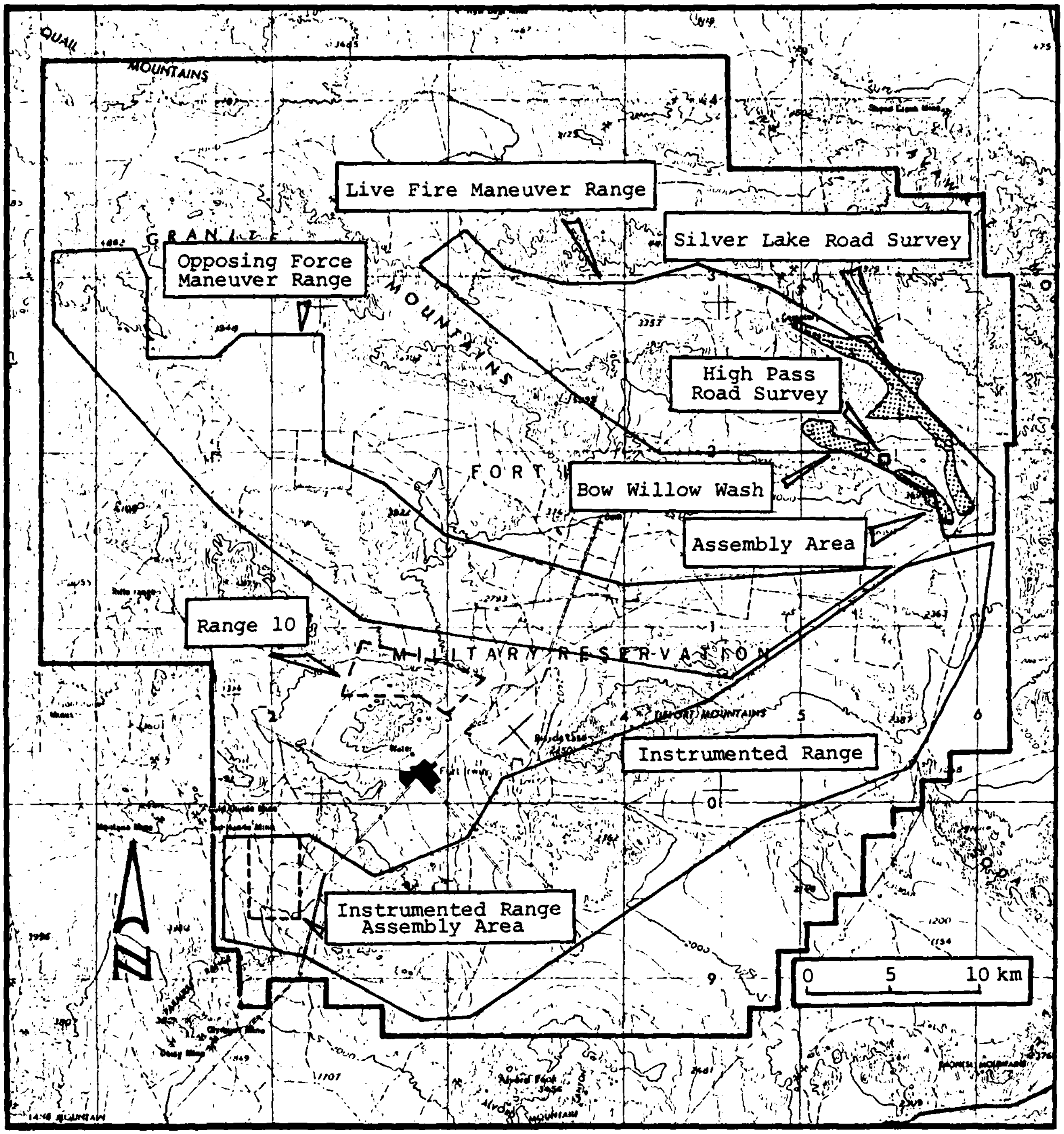


Figure 2

Illustrated on the above map of Fort Irwin are the study areas located within the planned tactical training ranges proposed for the National Training Center (NTC). The map is constructed on a U.S.G.S. 2° topographic map, Trona Quadrangle, from data provided by Division and Facilities Engineering, NTC.

designations (for sites and isolates, respectively), on standard maps and site forms

4) Determination of precise locations, boundaries, descriptions, and evaluations of significance of all loci within sites 4-SBr-4204, -4249, -4515, and -4516

5) Inspection of the subsurface aspect at locus SAD-1, site 4-SBr-4204

6) Completion of a comprehensive document reporting the total research program

7) Proper temporary curation of collected and recovered artifacts.

ENVIRONMENTAL SETTING

The Fort Irwin landscape consists of scattered mountain ranges and shallow dry lake basins ranging in elevation from 5,042 feet above mean sea level at Tiefort Mountain to 1,360 feet at Bitter Spring. The region currently supports an arid to semi-arid environment, although geoclimatic evidence indicates an earlier, more moist climate.

Landform is characterized by transverse (northwest/southeast) mountainous regions and shallow basins, representing the northeasternmost portion of the "Mojave Block" (Hewitt 1954). This is a large fault block uplifted and formed by movement along the Garlock Fault on the north and the San Andreas Fault to the southwest. The entire block is tilted to the southeast, creating a stepped order of decreasing elevations in that direction. The Garlock hinge fault system has created two different worlds out of what was once a continuous Pliocene landscape. Three million years ago there were no Sierra, Argus, and Panamint ranges as are now known. Instead, low rolling hills surrounded a large lake stretching from approximately the position of Koehn Lake northward to Big Pine. The deep sediments of this lake were subsequently capped by basalt flows and are known as the Ricardo Formation. The lake silt/basalt overlay is today visible halfway up the mountainsides along the Owens Valley face of the Inyos.

The basins in the northeastern portion of the Mojave Block are distinctive from the Basin and Range geomorphic province; that is, they have not been developed to the same degree by the structural tectonic processes that account for parallel systems of block-faulted mountains alternated with down-thrown lake basins that occur immediately north of the Garlock Fault. This distinction is caused by dramatic uplifing, folding, and stretching of the landscape along the north side of the Garlock Fracture (China, Searles, Panamint, and Death valleys), while the south

side of the cut or fracture has been left relatively smooth and unchanged. Leach, Drinkwater, No Name, Red Pass, Nelson, and McLean lakes occupy this older, southern topography. The southern half of the Garlock universe probably remains much the same as did the low-relief universe of Garlock-north before subduction of the Pacific Plate and rapid slippage along the San Andreas Fault commenced major remodelling and deformation of the northern and eastern zones of the California desert.

The availability of water (climatically determined) and water retention (controlled by basin cross sections), combined with the rate of evapotranspiration, would have made the shallow southern lakes habitable only at optimal periods and seasons. Local drainage and basin-to-basin exchange of water were very important in determining the habitability of certain regions. A combination of available water, steady seepage, and broad, shallow margins or channels where water could pond and plant communities could flourish created an ideal habitat. Such an optimal water regime may have been present at a number of lake basins between 8,000 and 8,500 years ago and, earlier, 10,000 to 12,000 years ago. If the local basins in the Fort Irwin zone were sufficiently deep to contain permanent fresh water and aquatic resource communities 10,000 or 11,000 years ago, Rancholabrean animals may have been present. These elements would combine to make the region highly desirable for Paleo-Indian occupation and exploitation (as these patterns are currently understood).

The mountain areas in this region have steep and rough terrain with slopes generally greater than forty-five degrees. Upper slopes consist of talus and areas of exposed, fractured bedrock, while the lower slopes comprise the greatest body of the wide, low-angled alluvial fans that stretch downward and across the shallow basins. The predominant geologic formations are Mesozoic quartz-bearing granites. However, a number of volcanic flows intrude into these granites, and Cenozoic volcanic, Tertiary intrusive, and Jura-Trias metavolcanic rocks are all found locally (Jennings, Burnett and Troxel 1978). These materials may be sources for the unusually beautiful silicate stone that appears in flake scatters in archaeological sites.

The Granite and Tiefort Mountain ranges are composed of Mesozoic granite intrusives surrounded by areas of dissected alluvium and terrace gravels of probable Pleistocene age. Quaternary lake deposits of clay, silt, and fine sands are dispersed throughout the military reservation and include Bicycle Lake, Goldstone Lake, Nelson Lake, Red Pass Lake, Leach Lake, Langford Well Lake, McLean Lake, and Drinkwater Lake. The Avawatz Mountain area of Fort Irwin is diversely composed of earlier Precambrian metamorphic, Jura-Trias metavolcanic, and Mesozoic granitic rocks with Tertiary, Plio-Pleistocene, and Pleistocene nonmarine sedimentary deposits. The Goldstone Lake area consists predominantly of Tertiary volcanic deposits of basalt surrounded by

areas of Pleistocene nonmarine sedimentary and recent alluvium deposits.

Approximately 40 percent of the Fort Irwin area is underlain by alluvial and lacustrine deposits of various mixtures of clay, silt, sand, gravels, cobbles, and boulders cemented by caliche. The remaining 60 percent consists of granitic and metavolcanic bedrock with some metasedimentary and sedimentary rocks (U.S. Army 1979).

No permanent surface streams are located on Fort Irwin, although intermittent water flows occur after periods of intense rainfall. Dry lake beds throughout this portion of the Mojave Desert have frequently been found with stands of water as deep as ten feet during extremely wet seasons (Rogers 1939:Plate 1; Kaldenberg 1981:48; Drover 1981:personal communication). Several of the springs in the Fort Irwin vicinity were enhanced or developed in 1944 when redwood tanks were installed to provide year-round underground water storage. Eleven wells provide all of the water currently used at Fort Irwin. Eight of these wells, located within the cantonment area, provide about one-half of this water. The remaining three wells are in the vicinity of Bicycle Lake.

Four distinct plant communities can be distinguished on Fort Irwin: the alkali sink community, the creosote bush scrub community, the shadescale scrub community, and the Joshua tree woodland. The alkali sink community is located in poorly drained alkaline flats and adjacent to the playas. Species include <u>Atriplex porryi</u> (porry saltbush), <u>Atriplex polycarpa</u> (cattle spinach), and <u>Atriplex hymanelytra</u> (desert holly).

The creosote bush scrub community represents 85 percent of Fort Irwin's vegetative cover and occurs at elevations ranging from 1000 to 5000 feet above mean sea level. This scrub community dominates the well-drained soils of slopes, fans, and valleys. Species include <u>Larrea divaricata</u> or <u>Larrea tridentata</u> (creosote bush), <u>Hymenoclea salsola</u> (cheesebush), and <u>Ambrosia dumosa</u> (burrobush).

The shadescale scrub community grows on mesas and flats between 3,000 and 6,000 feet above mean sea level. This community includes <u>Atriplex confertifolia</u> (shadescale), <u>Grayia spinosa</u> (spiny hopsage), and <u>Erotia lanata</u> (winter fat).

Joshua tree woodland is found on well-drained mesas and slopes at 3,000 feet to more than 5,000 feet above mean sea level. Species include <u>Yucca brevifolia</u> (Joshua tree), <u>Yucca schidigera</u> (mojave yucca), <u>Coleogyne ramosissima</u> (blackbush), <u>Juniperus</u> sp. (juniper), <u>Salazaria mexicana</u> (paper bag bush), and <u>Eriogonum fasciculatum</u> (California buckwheat) (U.S. Army 1979).

Fauna observed or noted during previous study include rodents, reptiles, and birds (Davis, Eckhardt and Hatley 1980). In addition, large mammals, such as Ovis canadensis nelsonii (desert bighorn sheep), Canis latrans (coyote), Lynx rufus (bobcat), Vulpes macrotis (desert kit fox), and Taxidia taxus (badger), are also known to frequent the area (U.S. Army 1979).

The climate, like all of the Mojave Desert, is arid to semi-arid, with evaporation acting as the controlling factor. Rain, which generally occurs between December and February, averages 1.5 inches annually. Occasionally, however, thunderstorms producing flash floods occur during the summer. Temperatures often reach 110°F to 120°F in the summer and can drop as low as 0°F during winter. In addition, strong winds accompanied by dust storms often occur during the winter (U.S. Army 1979).

SECTION II

BACKGROUND INFORMATION

During the past two decades, a significant number of cultural researchers have focused their interests on the history and prehistory of the California desert. Beyond an examination of how the most recent populations (ca. A.D. 1600 to the present) used and survived this arid zone, studies have shown that evidence exists to document human activity patterns occurring in this region as early as 11,500 years before the present (Rogers 1929, 1939; Campbell and Campbell 1935, 1937, 1940; Davis 1963; Davis, Brott and Weide 1969; Davis et al. 1978). Earlier patterns of human prehistory in this area have also been deduced from research in several widely spread localities (Carter 1957; Wormington 1957; Simpson 1972; Childers 1977; Singer 1979; Childers and Minshall 1980; Davis, Brown and Nichols 1980), patterns which may represent the presence of man in the New World as early as 200,000 years ago.

Ethnographic efforts and many archaeological studies offer much useful information regarding the most recent historic and prehistoric Native American populations. Broad overviews, including discussions of California desert cultures, have been prepared (Kroeber 1925; Heizer and Whipple 1957; Hester 1973; Heizer 1978), but a full digest of all (or even most) data currently available for this region has yet to be compiled. On the other hand, recent studies by the U.S. Department of the Interior, Bureau of Land Management, present a rather extensive mosaic of the Native American and early Euro-American cultural spectra for large portions of the California desert zone (King and Casebier 1976; Brooks, Wilson and Brooks 1978; Norris and Carrico 1978; Coombs 1978, 1979; Norwood and Bull 1979; Davis, Brown and Nichols 1980; Warren, Knack and von Till Warren 1980; Stickel and Weinman-Roberts 1979). These patterns and interpretations, of course, remain to be intensively tested against the ethnographic and archaeological records.

Little cultural resource assessment and research have been carried out within the boundaries of the Fort Irwin Military Reservation. Both Malcolm Rogers and Stuart Peck may have visited this region in concert with a review of aboriginal turquoise mining sites (Rogers 1929) and test excavations at Seep Springs, Black Canyon, and Opal Mountain (Peck 1939a, 1939b, 1940). Field notes and site records prepared by Malcolm Rogers for the San Diego Museum of Man reflect early visits and recording at localities such as Nelson and Drinkwater dry lakes, Drinkwater, Cave, and Bitter springs, and other areas within the reservation boundaries (Rogers n.d.:field notes and site records).

Several localities have previously been subjected to cursory inspection (Smith 1975; Kaldenberg 1978; Smith 1978; Alsoszatei-Petheo 1978), but no thorough inventory or impact mitigation program has yet been conducted. Prior to designation of Fort Irwin as a U.S. Army National Training Center, only a single military exercise, the 1980 Gallant Eagle exercise, had previously been subjected to the requirement of serious intensive survey techniques, preliminary analysis, recommended measures to mitigate impacts, and post-use compliance examination (Kaldenberg 1980a, 1980b). These inspections and emergency compliance measures occurred without benefit of an up-to-date and thoroughly professional cultural overview to gain perspective on the full significance of the archaeological sites identified. Following designation of Fort Irwin as the National Training Center by the U.S. Army, systematic cultural resource surveys of priority impact areas of the Live Fire Maneuver Range and cantonment area were initiated (Davis, Eckhardt and Hatley 1980, 1981; Bull 1980; Hanna et al. 1981). In all, some 250 cultural resource sites have so far been recorded (Kaldenberg 1980a:site forms, 1981; Davis, Eckhardt and Hatley 1980, 1981; Bull 1980; Hanna et al. 1981), while informal predictive estimates and ongoing reconnaissance suggest the total inventory will be significantly greater (Walker 1980:personal communication; Underwood 1981:personal communication).

Although a complete literature review pertaining to the prehistoric cultural resources of the Fort Irwin Military Reservation is well beyond the allowable time frame and scope of the current project, it is necessary to briefly consider the merits of what is already known through previous research elsewhere in the Mojave Desert and the southwestern Great Basin regions. This matrix of existing information forms the most reasonable perspective of how indigenous populations might have occupied and used the lands now known as the Fort Irwin Military Reservation. Furthermore, such a review focuses attention on regional domains of research and identifies specific research problems which should be addressed in future investigation of the resources at hand.

REGIONAL OVERVIEW

The focus of archaeological study and research into Great Basin prehistory has long been the ecological adaptive responses of prehistoric populations to what many have called a harsh environment (Kroeber 1925:583-585; Meighan 1959:49; Wallace 1962:172; Hester 1973:1). This has resulted in a wide array of anthropologically oriented endeavors which delve into the subsistence patterns, settlement systems, and ecological adaptations of Great Basin cultures. The Mojave Desert, which occupies a large portion of the southwestern Great Basin region, contains significant

information regarding the nature and development of populations for the prehistoric periods.

An understanding of prehistoric activities and behavior patterns for indigenous populations in the Mojave Desert region must be constructed from analyses of both the archaeological literature and the material record (or residues) found in archaeological contexts. As used here, context includes both the pertinent cultural setting and the physiographic, geomorphologic, and ecologic settings. Only in the Proto-historic/Historic Period (ca. 200 years B.P. to present)--and perhaps, by inference, the Late Prehistoric/Early Prehistoric Period (ca. 3,000 to 200 years B.P.)--is this evidence firmly corroborated or supported by ethnographic information. The remainder of Man's record in this region must rely on broad social concepts and wide-ranging cultural patterns observed elsewhere.

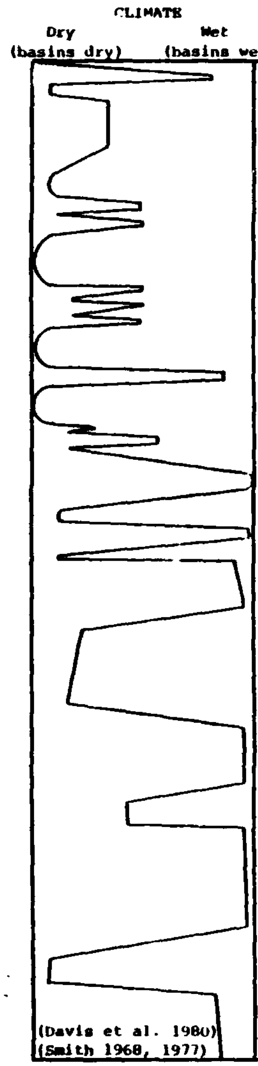
Table 1 represents a proposed cultural chronology for the Fort Irwin region and several antecedent chronologies used and considered in this prehistoric cultural overview. The ambiguity and relativity of the scales used as temporal frameworks are inherent; reconstruction of these several cultural periods and refinement of their absolute and relative dates has and will continue to require many shifts in presentation and adjustment before less ambiguous chronologies may be presented.

Because chronology is a benchmark to any explanation of cultural process, change, or the dynamics thereof, a broad spectrum of dating techniques have been applied to this region. Both relative and absolute chronological methods have been used, including geochronological, paleontological, and climatic dating, radiocarbon dating of archaeological strata and geologic phenomena, obsidian hydration, relative patination and weathering of stone artifacts, and the use of various types of artifacts as chronological mileposts. Nonetheless, chronology and temporal placement of cultural and temporal units recorded in this region are far from certain, and numerous factors remain as serious concerns for future research.

Past climates and environments of this region are better understood than cultural chronology. Through the application of research in fields such as geology, geomorphology, paleontology, and paleoecology to questions of archaeological value, a broad-based geoclimatological framework has been developed (Antevs 1952; Troxell and Hofmann 1954; Aschmann 1958; Smith 1968; King 1976, 1981; Baumhoff and Heizer 1965). This framework has permitted recent investigators to more accurately assess the relative antiquity of their subjects (Davis, Brott and Weide 1969; King 1976; Davis et al. 1978; Drover 1979).

Table 1

PROPOSED CULTURAL CHRONOLOGY AND ANTECEDENT GENERAL REGIONAL CULTURAL RECONSTRUCTIONS



TIME B.P. (Before Present)	GENERALIZED CULTURE/COMPLEX	PROPOSED CHRONOLOGY (Period or Tradition)	ANTECEDENT CULTURAL RECONSTRUCTIONS			
			YUMAN, SHOSHONEAN, PAIUTE	PREHISTORIC YUMAN AND SHOSHONEAN	POST CONTACT / POTTERY	LATE PREHISTORIC
1,000	Shoshonean / Yuman (Kroeber 1925)	LATE PREHISTORIC				
2,000			AMARGOSAN	AMARGOSAN	MILLING (ARCHAIC)	ROSE SPRING/EASTGATE
3,000	Desert Traditions (Davis et al. 1980)		SAN DIEGUITO II, III / PINTO-GYPSUM	PINTO BASIN	EARLY MILLING (ARCHAIC)	GREAT BASIN ARCHAIC
4,000	Pinto Complex (Campbell & Campbell 1935)	EARLY PREHISTORIC	PLAYA I, II / SAN DIEGUITO I			
5,000			MALPAIS			
6,000						
7,000		TERMINAL PALEO-INDIAN			TERMINAL PALEO-INDIAN	SCANTY OCCUPATION
8,000						
9,000	San Dieguito III Desert Facies (Rogers 1939)	WESTERN LITHIC CO-TRADITION (PALEO-INDIAN)	?			
10,000					WESTERN LITHIC CO-TRADITION	WESTERN PLUVIAL LAKES TRADITIONS
11,000	Clovis/Lake Mojave Complex (Davis et al. 1978); ...Haskomat... (Butler 1961)			LAKE MOJAVE		
12,000		FLUTING CO-TRADITION (PALEO-INDIAN)			FLUTING CO-TRADITION	FLUTED PROJECTILE POINT TRADITION
13,000						
14,000	San Dieguito II Desert Facies (Rogers 1939)			?		PRE-PROJECTILE POINT
15,000						
16,000		EARLY PALEO-INDIAN			EARLY PALEO-INDIAN	
17,000	San Dieguito I Desert Facies (Rogers et al. 1966)					
18,000						
19,000						
20,000	Archaeolithic Complex (Davis et al. 1980)	MACROLITH, BLADE AND FLAKE CO-TRADITIONS				
21,000						
22,000						
23,000						
24,000						
25,000						
			(Rogers 1939)	(Wallace 1962)	(Davis 1970)	(Hester 1973)

Pre-Projectile Point Period

Recent research in both coastal and inland southern California has raised the very real possibility of a pre-projectile point (Hester 1973), pre-Paleo-Indian culture. This is proposed as the Pre-Projectile Point Period in Table 1. Unfortunately, some of the data remains ambiguous and often outright suspect. The equivocal nature of the evidence for "Early Man" or pre-projectile point cultures is due partly to the random methods of collection and biased analyses often employed by its advocates and partly to the probability that remnants of such an ancient culture will be sporadic and not easily recognized. Much of the early documentation of pre-projectile point cultures has been broadly conceived and short on substantiation (Carter 1957; Clements and Clements 1953). Nonetheless, the concept of an early pre-projectile cultural stratum in North America related, in part, to the Paleolithic in Europe has been alluded to by various individuals (Krieger 1962; Jennings 1964; MacNeish 1973; and Willey and Phillips 1955).

Since the inception of California desert archaeology, much interest has focused on its earliest manifestations. In recent years several of the oldest claims for New World prehistoric occupation have originated from the study of cultural deposits recorded along the shorelines of Pleistocene Lake Manix (Coyote and Troy dry lakes) in the Mojave Desert (Simpson 1952, 1956, 1962). Much of the material lies on heavily deflated surfaces whose antiquity is difficult to determine, and assignment of age based on similarities in form to the Old World Paleolithic is insufficient (see Simpson 1960:33-35, 1961:34). While the surface aspects of the Lake Manix Lithic Industry are generally regarded as artifactual, the antiquity and integrity of specimens recovered from subsurface excavations are highly debated (Leakey et al. 1972). Continuing analysis of the Calico site and supposedly contemporaneous lithic traditions, as defined by Ruth D. Simpson, may provide verification of a pre-projectile point desert complex (Simpson 1972; Schuiling 1979). Geomorphological examination of the Calico site, supported by uranium-thorium isotope dating techniques, has recently dated one level at roughly 200,000 years before the present (Bischoff et al. 1981:576-582).

E.L. Davis and others (Davis et al. 1978) in the China Lake region have identified other complexes considered part of this pre-projectile point period, beginning with the Core Tool Tradition (45,000 to 25,000 years before the present), followed by the Late Wisconsin Culture I (25,000 to 20,000 years before the present), Late Wisconsin Culture II (20,000 to 15,000 years before the present), and Proto-Clovis Culture (15,000 to 13,000 years before the present) complexes. Artifacts characteristic of the three earliest periods are reported to include chopping tools, spokeshaves, scraping tools, ovate knives, borers and cutters (bifacial and flaked), and proto-Clovis materials containing

additional new technologies of bifacial thinning, incipient fluting (and basal thinning), and more discrete artifactual forms (Davis et al. 1978:Figures 8-10). In her analysis, Davis postulates an alternative hypothesis for the rapid development of classic Clovis expression eastward in the Great Plains region:

> . . . it appears likely that a cultural peak was reached during the Classic Clovis Phase in Lake China areas prior to 11,500 years B.P. After this, rapid changes took place: the climate became warmer and drier, destroying lake and savanna habitats of the megaherbivores (Guilday 1967) and intermontane regions became less attractive while a spread of grassland made the developing Great Plains more inviting. Both animals and people flowed northeastward, thereby accounting for the mysterious suddenness of Clovis appearances, contemporaneously, over wide areas of the midcontinent (Davis et al. 1978:13).

The Malpais Tradition, first defined by Rogers (1929, 1939), is potentially the terminal culture complex of this pre-projectile point period. As reported by Rogers, sites of the Malpais Tradition are widespread in both the Mojave and Colorado desert regions, with an assemblage characterized by the lack of projectile points, but containing large, percussion-flaked bifaces, scrapers, flakes, and cores. These crude stone tools are often found at or near the parent lithic source zones and also in association with trails, cairns, and cleared areas in the desert pavement known as "sleeping" or "house" circles. The estimated age of this complex was set at 4,000 B.P. by Rogers (1939:Plate 21); however, a revised possibility of 8,000 B.P. was admitted prior to his death (Warren 1966:18).

Since 1939 authors have treated the "Malpais Industry" in a variety of ways. Some are reluctant to treat these data as an early, separate assemblage predating the use of projectiles (Bennyhoff 1958:Figure 1; Wallace 1962:174; Bettinger and Taylor 1974). However, continuing research has disclosed evidence of Malpais traditions and stone tool assemblages spread throughout the American Southwest, including the Trans-Pecos region in Texas (Ezell 1981:personal communication), the Sierra Pinacate in northwestern Sonora, Mexico (Hayden 1976), and numerous localities throughout the Colorado and Mojave deserts (Rogers 1939:Map 1). Geochronologic methods employed by Hayden suggest that, for the Pinacate region at least, artifacts are associated with an early, possibly localized altithermal climatic condition dated to roughly 16,000 to 18,000 years B.C. (or 17,900 to 19,900 years before the present) (Hayden 1976:286, Figure 9).

Tule Springs is another resource site once thought to be pre-projectile (Shutler et al. 1967; Shutler 1968). Through the years, observations of Pleistocene fauna in association with

charcoal gave way to speculations that the Tule Springs site, north of Las Vegas, may be older than 28,000 years (Harrington and Simpson 1961; Simpson 1933). A radiocarbon date exceeding 28,000 B.P. resulted from excavations by the Southwest Museum (Broeker and Kulp 1957). This date, in combination with a mixed sample excavated by Harrington and dated to 23,800 years ago (Libby 1955), was the focus of a later large-scale investigation in 1962 (Shutler et al. 1967:3, 5). Earlier claims could not be substantiated as only eight artifacts (five of which were flakes) were recovered dating between 10,000 to 13,000 years ago (Shutler et al. 1967:5-6). The paucity of material from this site makes interpretation difficult; however, the chronometric and paleoenvironmental evidence suggest this "occupation" may more correctly belong to the following Paleo-Indian Period (Western Lithic Co-Tradition).

The Paleo-Indian Period

The earliest well-documented cultural assemblages in this region date from postglacial/terminal Pleistocene times and are presented here as a series of four proposed Paleo-Indian Traditions (see Table 1). This chronology includes numerous localized variants which, based on tool typologies, environmental setting of reported sites, assumed cultural distributions, and potential for seriation of artifact forms and technique in manufacture, most probably represent regional and temporal manifestations of a broad cultural stage.

Pleistocene Lake Mojave, comprising what is today Soda and Silver lakes in north-central San Bernardino County, has been one major focus of study for this period (Campbell and Campbell 1937; Rogers 1939; Roberts 1940; Brainerd 1953; Meighan 1954; Warren and True 1961; Warren and DeCosta 1964; Heizer 1965; Woodward and Woodward 1966; Carter 1967; Davis 1967; Heizer 1970; Warren 1970; Ore and Warren 1971; Venner 1978; Warren and Ore 1978). The Lake Mojave Complex is one of many assemblages forming a widespread cultural horizon over the western Great Basin and most of California (Warren, Knack and von till Warren 1981:27). Another localized variation of this widespread horizon includes the San Dieguito Complex, clearly represented in sites from the San Diego coast to the California desert and adjacent areas (Rogers 1929b, 1939, 1958, 1960; Rogers et al. 1966; Moriarty 1969; Warren 1961, 1966, 1967). Depending on location and economic interpretation of the researcher, the Paleo-Indian Period has variously been named Playa Industry (Rogers 1939), San Dieguito Complex (Rogers et al. 1966), Lake Mojave Complex (Wallace 1962), Lake Mojave Pattern as part of a larger Western Lithic Co-Tradition (Davis, Brott and Weide 1969; Davis 1978), Western Pluvial Lakes Tradition (Bedwell 1970, 1973; Hester 1973), Lake Mojave-Pinto Tradition (Tuohy 1974), Haskomat and San Dieguito (Warren and Ranere 1968), Nevares Springs Culture (Wallace 1977), and Mojave Period (Bettinger and Taylor 1974).

Environmental conditions during the Paleo-Indian Period (ca. 18,000 to 6,000 B.P.) were substantially different from those of today. Throughout the Great Basin, and the northern Mojave Desert in particular, more moist and cooler conditions prevailed, bringing larger amounts of surface water to the drainages and basins, what Davis has termed the "Lakes Country" (Davis et al. 1978:14) in reference to this terminal Pleistocene period. Flora and fauna were also more verdant and diverse, making the region more profitable and inviting for human populations. It is the interpretation of how the peoples of this period exploited their environment--generalized hunting versus lacustrine adaptations--that remains in great debate.

Rogers and others characterize the Paleo-Indian Period as an early hunting tradition, with a lithic assemblage of primarily percussion-shaped flaked stone tools, including projectiles, crescentics, hammers, knives, blades, and choppers (Rogers 1929b; Campbell and Campbell 1937; Amsden 1937:51-80). Warren provides a fine overview and discussion of similarities among various western Paleo-Indian tool assemblages (1967:168-185) while explaining his hypothesis that Paleo-Indian peoples practicing a generalized hunting tradition moved out of the nondesert northern forests and into the now-arid desert lands:

> A culture adapted to the more northern moist climate, following a hunting, fishing, gathering pattern in which big mammals were of considerable importance, and supplemented by small game, fish and fowl, moving into the area during this period, would be best adapted to those ecological zones where bodies of fresh water were most stable and game most abundant. The north-south trending mountain ranges would provide a series of such zones. This is especially true of the Sierra Nevada and Peninsular ranges, from which a number of streams and rivers flowed into the lakes along the western edge of the Great Basin and the Mojave and Colorado Deserts. Here the environment was presumably similar to that of the Northwest. The lakes and streams provided ample water for game animals and water fowl, and the wooded areas presumably met the more open grass area scrub lands to form an ecotone or series of ecotones in which a larger variety of plants and animals was to be found than in adjacent ecological zones (Warren 1967:183-184).

A similar cultural construct was developed by Bedwell (1970, 1973) and Hester (1973)--known as Western Pluvial Lakes Tradition--stressing a lacustrine adaptation by cultures of this period. This construct has been seriously criticized (Heid, Warren and Rocchio 1979) on the basis that: 1) lithic assemblages appear specialized for hunting and are not oriented toward lacustrine resources; 2) correlations of site locations with pluvial

lakeshores reflect a sampling bias for pluvial lake environments; and 3) the few sites where faunal or floral remains are reported reflect a more generalized hunting, fishing, and gathering pattern than a lacustrine adaptation would imply (Warren, Knack and von Till Warren 1980:30).

Cultural variation in the Paleo-Indian Period is expressed both in the demography and lithic assemblages of characteristic sites found throughout the extreme southwestern United States. Early Paleo-Indian sites are frequently high above existing water sources and in settings suggestive of occupation contemporaneous with a much wetter, more lush environment. Apparently, these peoples thrived in the desert regions of southeast California, as well as occupying the coastal plain of California and, perhaps, the Peninsular Range.

In general, the ancient hunters of the San Dieguito I phase (Early Paleo-Indian) have left little or no permanent record. Assemblages of scattered lithic tools, waste stone debris, and two burials have been assigned to this period. One of the two burials, discovered in the early 1970s in the Yuha Basin-Truckhaven area, may be associated with the earlier Malpais culture (Rogers 1929:25-31; Wallace 1955:189-191; Ezell 1974:personal communication; Childers 1974) or Pre-Projectile Point Period (see Table 1). Generally, these Early Paleo-Indian people manufactured and used crudely formed stone flakes, blades, and scrapers. More specifically, tool assemblages are characterized by ovate bifaces, spokeshaves, bilateral notched pebbles, scrapers/scraper planes, and chopping tools. Many investigators, including Rogers et al. (1966), thought that so-called sleeping circles and geometric stone alignments (geoglyphs) were of San Dieguito origin.

The ovate biface is the closest San Dieguito phase I people came to having a stone knife form (Rogers et al. 1966:157). Most are informal (loosely patterned), bifacial, percussion-flaked, and ovoid in outline (Rogers et al. 1966:157; Rogers 1939:Plate 5). Gravers, while not common at all sites, were manufactured from amorphous flakes most suitable for the purpose (Rogers et al. 1966:158). Macro-flakes, or "teshoa" flakes, were reported on nearly every Early Paleo-Indian site:

> They occur in such great numbers that wastage alone cannot account for them, and, by inference, one may deduce that their makers considered them to be finished products (Rogers et al. 1966:156).

Rogers felt the lack of complex tool patterns and the apparent meager amounts of worked stone left by these people were explained by the diffuse nature of their occupation (Rogers et al. 1966:37). Comparing the San Dieguito I material to the everyday life of the protohistoric Pericu of Baja California, Baegert (1772) noted there were no permanent camps and the people

seldom slept in the same place for over three consecutive nights (Rogers et al. 1966:38). A sexual division of labor and diffuse patterns of exploitation were also noted. Rogers speculated that these behaviors were potentially representative of the early nomadic San Dieguito I peoples and that their influence on problems of interpretation should not go unrecognized (Rogers et al. 1966:38).

Certain refinements in technologic development are evident in San Dieguito II assemblages found in the desert areas. Lithic artifacts include more finely worked blades, somewhat smaller and lighter points, and a larger variety of scrapers, choppers, and knives. In general, however, the same morphological types remain basically unchanged from the earlier phase. Like their predecessors, these people were medium-to-large game hunters, although foraging must have served to supplement their diet (Warren 1961:262; Moriarty 1969:1-18), perhaps to a greater extent than most scholars have implied.

Rogers found the inventory of San Dieguito II sites associated with fossil stream channels considerably larger than the number found along the perimeter of dry lake beds (Rogers et al. 1966:59). While he and others have explained this variation as a cultural response to harsh, cold environments (i.e., the high plateau country of western San Bernardino County), other factors may have masked the presence of central-period Paleo-Indian materials along lakeshores at higher elevations. Extreme amounts of alluvium have covered the older shores of many lakes in this region, leaving their Pleistocene and post-Pleistocene shorelines buried by recent alluvial soils, eliminating the opportunity to discover any early surface patterns of lakeshore exploitation (Rogers n.d.:site records and notes for sites M-72, M-98, and M-106; Abbott 1981).

The San Dieguito III technology represents a morphological and typological change. The tool types become far more varied both in style and in functional design, thus indicating a development or change in culturally determined patterns of tool manufacture. Such alteration can be attributed to environmental adaptation or technological advances that progressively create new technological modes.

As a result of such changes, the later Paleo-Indian tools are more variable and exhibit fundamental refinement in their manufacture. A primary difference is the introduction of pressure-flaking. Unlike simple percussion flaking, pressure flaking requires a more delicate touch and a more refined mental preconception. The resulting tools exhibit form, complexity, and balance not found in the early phases of the Paleo-Indian tradition.

Other diagnostic traits associated with the San Dieguito III phase include planes, choppers, plano-convex scrapers, crescentic

stones, elongated bifacial knives, and intricate leaf-shaped projectile points (Rogers 1939:28-31; Rogers et al. 1966). No absolute method of distinguishing between San Dieguito II and III exists beyond specific tool types and the introduction of pressure flaking. Patination, a weathering process involving chemical change on the surface of stones, is a relative guide to antiquity and may provide gross distinctions between the San Dieguito phases; however, its use is limited by the many variables involved in its application (cf. Arnold 1971; Alsoszatei-Petheo 1975; Bard, Asaro and Heizer 1976; Laudermilk 1931; Dorn 1982).

E.L. Davis, working in the Panamint Basin, noted broad correspondences between Paleo-Indian artifact forms from widely distributed localities and over long periods of time:

> A number of correspondences were noted between these [other western sites] and Panamint, particularly at early levels, leading to the following hypothesis: as early as 8,000 B.C., a widely distributed series of related, lithic industries existed in the Great Basin and throughout desert, south coastal and peninsular California. This probably persisted with minor changes for thousands of years. As change accelerated and other influences invaded the vast area, highly styled artifacts were rapidly altered or replaced; however there remained until recently a substratum of core tools, choppers, chopping tools and a predominance of side-struck or at least ovate flakes rather than blades. . .these related lithic industries are called the Western Lithic Co-tradition (Davis, Brott and Weide 1969:13).

Davis inferred from Panamint, Humboldt Sink, Lind Coulee (Daugherty 1956), Lake Mojave, San Dieguito River, and Death Valley tool kits that hunter-collectors with comparable adaptations and technologies were scattered throughout the deserts of California and Nevada, into the Plateau, and down into Baja California (Davis, Brott and Weide 1969:22). Davis lists the following artifact patterns as characterizing the Western Lithic Co-Tradition: weak-shouldered, long-stemmed point/knives, side-struck flakes, macro-flakes, amorphous cores, large end-scrapers, spokeshaves, crescentics, high-domed planes, step flaking, pressure retouch point/knives made on flakes, knife/ points made on ovate blanks, an emphasis on ovate bifaces of all sizes, proportions, and degrees of completeness, choppers, and chopping tools. Additional traits include a scarcity of blades and an apparent absence of milling equipment.

Reporting the later work from Lake China (Davis et al. 1978), Davis further postulated a fluting co-tradition from which the Clovis developed before moving northeastward into the Great

Plains. These Fluting and Western Lithic Co-Traditions comprise the central core to the Paleo-Indian Period presented in Table 1.

Warren and Ranere (1968) analyzed the artifacts from Lake Mojave and outlined the significant assemblage variations. Three distinct cultural expressions were recognized: Fluted Points, San Dieguito, and Haskomat. Warren noted that:

> Some forms of artifacts appear to be shared by the Haskomat and San Dieguito complexes. However, the stone flaking technologies appear to differ. The Haskomat projectile points, for example, were most often executed by well-controlled direct percussion with collateral flaking at right angle to the margin followed by delicate pressure flaking at the margins. This results in straight lateral margins and thin lenticular cross sections. San Dieguito points, on the other hand, were made by a relatively crude percussion technology resulting in deep negative bulbs of percussion with step fractures producing irregular edges and surfaces. Edges are also often flat and crushed as if supported on an anvil (Warren, Knack and von Till Warren 1980:32).

Although the Haskomat and San Dieguito complexes are both represented at Lake Mojave, Warren and Ranere (1968) note that San Dieguito appears more characteristic of the Mojave Desert and that Haskomat may be primarily a northwestern Great Basin phenomena.

Current knowledge of the distribution and content of Paleo-Indian Period sites suggests that several critical factors remain to be investigated before a thorough synthesis can be obtained. Competing and corresponding theories related to economic, procurement, and socio-cultural practices of these early peoples remain to be tested against the archaeological record. Paleo-Indian sites at springs, ancient marshes, and upland resource areas need to be surveyed and tested for early occupations at other than Pleistocene lakeshore environments. Renewed interest in functional and technological analyses of artifact types should be fostered in hope that statements or inferences about particular tool usage and temporal/regional associations may be generated. Absolute and relative dating should be expanded to secure a more complete chronology. Numerous answers--and perhaps as many questions--related to the supposed cultural abandonment of the Mojave Desert in later times may be found by more detailed examination of this pivotal Paleo-Indian cultural period.

Early Prehistoric Period

The material culture assemblages and geographical extent of

the Early Prehistoric Period is still unclear. The Desert Cultures (Jennings 1964) or Traditions (Davis, Brown and Nichols 1980) arose during this period, and a reliance on seeds, nuts, and berries to supplement animal protein is well evidenced by milling stone technology, including seed-grinding implements, handstones, and milling surfaces (Rogers 1939:52; Wallace 1962:175; Davis 1970:Table 11). Although these people collected and processed available local vegetation, the material record suggests their generalized collection set or kitchen mode was predicated on hunting (Wallace 1962:175). Projectile points are lanceolate shaped with weak shoulders and short stems, too thick and heavy for use with arrows, but well suited for use with dart and atlatl. Broad fluctuations in climate must have affected vegetation and game supply (see Table 1). Such conditions would have imposed adaptive strategies that limited population and required frequent migrations to seasonally available resources (Rogers 1939:56-57; Wallace 1962:175; Davis 1970:120-121).

Several authors have suggested a cultural hiatus or abandonment of the Mojave Desert during this period (ca. 5,950 to 7,950 B.P.) (Wallace 1962:175; Hall and Barker 1975:44). The idea of cultural abandonment stems in part from Antevs' concept of a climatic altithermal when conditions were thought to be more arid than today (Antevs 1955). Although it is presently conceded that such conditions may have occurred on a large scale, the effect on localized populations may have been nonexistent (Bettinger and Taylor 1974:14; Hall and Barker 1975:55-56; Elston 1976). Possibly the supposed hiatus simply reflects a subsistence shift or a material culture "transitional stage" (Davis et al. 1978:15).

Jennings, discussing what he calls Desert Culture, posits a widespread, uniform "culture" existing with no significant change between 4,950 to 9,950 B.P. (Jennings 1964:50). Swanson (1966:144-145), on the other hand, suggests changes in the environment caused one-time big game hunters to rely more on plant foods, thus creating the "Desert Culture" (cf. Warren and Ranere 1968; Ranere 1970). Regardless of the cause, it appears that similarities in material culture become rather widespread during the Early Prehistoric in the desert west, including:

> . . . basketry, netting, fur cloth, woven sandals, the spear thrower, hardwood dart points, stone tools preferrably of basalt and quartzite in the early stages (with a shift toward obsidian and other glassy materials later), flat milling stone, many specialized stone tools, scrapers, choppers, pulping planes of crude appearance, digging stick, curved wooden clubs, fire drill and hearth, tubular pipes, and imported shells from California for ornaments (Jennings 1964:85).

The Archaic Stage (Early Prehistoric Period) in the southern Great Basin is commonly divided into two phases, "Pinto-Gypsum"

and "Amargosa." Each is characterized by a distinctive projectile point series (Rogers 1939; Bennyhoff 1958; Wallace 1962; Bettinger and Taylor 1974). The first Archaic Stage includes Pinto projectiles (Campbell and Amsden 1934; cf. Campbell and Campbell 1935) and Silver Lake points (Amsden 1937) as a holdover from the Paleo-Indian Period. Several authors have suggested the term "Pinto" should not apply to regional variants such as "Little Lake" (Lanning 1963) or to "Humboldt" (Clewlow 1967). For a further discussion of projectile varieties and relationships, see Bettinger and Taylor (1974) and Hall and Barker (1975).

Atlatl use is inferred for the Pinto projectiles (Wallace 1962:175; cf. Fenenga 1953). Besides the distinctive projectile forms, this period can also be characterized by the appearance of other chipped stone articles such as leaf-shaped points, knife blades, and drills. Wallace describes the following:

> A substantial number of rough surface tools in the form of hammers, choppers, and scraper planes are present. Seed-grinding implements, handstones and milling stones, are represented in relatively small numbers. The camping spots produced no clear-cut evidences of house remains, hearths or foodstuffs (Wallace 1962:175).

Although several authors (Rogers 1939:47-60; Bennyhoff 1958:Figure 1; Wallace 1962:176) integrate the Pinto and Gypsum (Gypsum Cave) complexes, the association has been questioned and the latter thought to be older (Harrington 1957:73).

Using materials from the Amargosa River, Rogers (1939) attempted to define two phases within his Amargosa concept. He equated Pinto-Gypsum with the Basketmaker of the Southwest (1939:Plate 21, 61) and further suggested a correspondence between Amargosa I with Basketmaker II and Amargosa II with Basketmaker III. Amargosa I was thought to have its focus within the Pinto-Gypsum Complex area (Rogers 1939:61), but was indistinguishable from a closing phase of the Pinto Industry. The associations between Amargosa I and II and Basketmaker II and III, respectively, were based on the presence of dart points, arrow points, and pot sherds of the ". . . Nevada Basket-maker III types" (Rogers 1939:61). Rogers' familiarity with southern Nevada materials stems from the work of Harrington (1930, 1957). Since Basketmaker I was never fully defined in the Southwest, the similarities between the non-ceramic desert cultures that precede Basketmaker II and III developments in the greater Southwest may warrant Rogers' designation of "Basketmaker I." As will be seen, modern geographic boundaries often result in conceptual boundaries, resulting in a failure to recognize trans-Colorado River relationships.

Phase I of the Amargosa is not known in much detail outside of Rogers' initial description (1939). Five categories of artifacts, scrapers, knives, drills, slate jewelry, and dart points, comprise the assemblage (Rogers 1939:62-64). The dart points--short, corner-notched with flat bases--are presently termed Elko-Eared (O'Connell 1967; Bettinger and Taylor 1974). Wallace likens these points to ". . . those in use during Basketmaker times in the Southwest" (1962:176). No milling stone is described for this phase, although this absence may result from sampling phenomena. In the original Pecos classification, Basketmaker I is non-ceramic and non-horticultural. While Basketmaker II adds horticulture, ceramics do not appear until Basketmaker III times. Since the phase I aspect of the Amargosa is considered equal to Basketmaker II, one would expect milling stones, the lack of which Wallace finds bothersome (1962:176). Rogers, however, expresses remorse at the small sample and lack of ". . . pure type-sites" (1939:62) and suggests culture lag to account for California-Arizona discrepencies (1939:72).

Late Prehistoric Period

On the basis of reconstructed material culture and demographic distribution, what others have called Amargosa II (Rogers 1939:61), Amargosan (Wallace 1962:176), Milling Archaic (Davis 1970:117), and Rose Spring/Eastgate (Hester 1973; Heizer and Hester 1978:7-10) are here included in the proposed Late Prehistoric Period (see Table 1). Considering the projectile point types occurring in this stage, development of the bow and arrow may have superseded the dart and atlatl as prime hunting instruments (Heizer and Hester 1978:7-8; Wallace 1962:176; Rogers 1939:65). The milling of vegetable foods is inferred for this period, suggesting a mixed subsistence strategy with reliance on foraging, small game, and prepared meal (Wallace 1962:176; Rogers 1939:65).

Rogers' second phase of the Amargosa (Basketmaker III) more clearly demonstrates affinities between the Amargosa and the Southwest. Newberry Cave (Smith et al. 1957) and Gypsum Cave (Harrington 1933) both were occupied in the early part of Amargosa II. These protected, dry caves have preserved much of the organic part of the artifactual assemblage. Examples of organic remains from Newberry Cave are extensive and include atlatl dart fragments, cordage, adhesive on projectiles, painted deerskin, feather tassels, faunal remains (big horn sheep, rabbit, tortoise), a tortoise shell bowl, bone awls, wooden cylinders, sandals, split-twig figurines, a sheep dung pendant, and an atlatl hook (Smith et al. 1957:164-165).

Manos and metates have been recovered from these dry cave sites, and the bow and arrow appear to have replaced the atlatl late in Amargosa II times. The earliest projectiles attributable to bow and arrow propulsion were still large but considerably

thinner and lighter than those of earlier periods and are known as "Elko corner-notched" (O'Connell 1967; cf. Rogers 1939:Plate 16; Bettinger and Taylor 1974:Figure 2).

No extinct fauna was recovered from Newberry Cave (Smith et al. 1957:168); however, occupancy of Gypsum Cave was apparently contemporaneous with the ground sloth (Harrington 1933:69-70). Several radiocarbon assays from split-twig figurines and dart shafts have yielded dates of 3,150 to 3,275 B.P. (Smith 1963), 3,075 to 3,150 B.P. and 2,475 to 2,725 B.P. (Heizer and Berger 1970). Although Smith saw similarities between the Newberry Cave assemblage and the Basketmaker III horizon in southern Nevada and Rogers' Amargosa II (1957:166), the site more properly belongs to the elusive Amargosa I/II transition. While occupancy of the Mojave Desert during Amargosa times is little understood, clear affiliations with the greater southwest seem evident.

Perhaps the most intensive Late Prehistoric Period use of the Mojave Desert occured at the turquoise mining areas near Halloran Springs (Eisen 1898; Rogers 1939). Interest in the prehistoric mining activities spurred the San Francisco Call newspaper to organize an exploratory expedition in 1898 led by archaeologist Gustav Eisen (Pogue 1915:46). The prehistoric quarrying activities also encouraged Malcolm Rogers' first studies in the Mojave Sink region (1929). More recently, studies of cultural affiliations and quarrying techniques have been conducted by Leonard and Drover (1979).

The Halloran Springs mining region is approximately eight to fourteen miles long and three miles wide with evidence of extensive use (Rogers 1929:2-3). Sigleo (1975:459) and Rogers (1929) suggest an Amargosa II or Basketmaker III age for the beginning of mining at Halloran Springs. Although Rogers recognized no Mojave (Yuman) ceramics, he is equivocal regarding cultural affiliations of the miners.

Turquoise beads recovered from room fill of a Gila Butte Phase house (A.D. 500-700) at the Hohokam site of Snaketown in south-central Arizona originated at Halloran Springs origin (Sigleo 1975). Finely finished three-quarter-groove stone axes are further evidence of possible Hohokam contact (see Rogers 1939:Plate II, 3). Inspection of the coil and scrape gray wares, however, suggests a Virgin-Kayenta relationship (Rogers 1939:65; Leonard and Drover 1979), evidence of possible Puebloid exploitation.

Rogers' belief that the Amargosa phases were influenced by, or were part of, cultural traditions (Basketmaker) in the Southwest seems accurate. It may also include the eastern half of the Mojave Desert from approximately 2,950 B.P. until ethnohistoric times (cf. Willey 1966:180; Kroeber 1920, 1923). Pottery and domesticated plants were eventually added to the similar

Californian (Amargosan) and Arizonan (Cochise) Late Prehistoric cultures. The intrusion of domesticated plants into the Mojave and Colorado deserts met with varying success (see Forbes 1963 and Lawton and Bean 1968). Although King and Casebier suggest the introduction of horticulture as early as Amargosa I times in the Mojave Desert (1976:29), supportive physical evidence has yet to be found.

Between A.D. 700 and 1,000, the introduction of smaller stemmed projectiles, suggesting the bow and arrow, appear, signifying a new "Rose Spring" or "East Gate" Complex to several authors (Bettinger and Taylor 1974; Hall and Barker 1975). This projectile series was apparently "lumped" or not recognized by Wallace (1962:Figure 1) or by Rogers (1929:Plates 16, 18, 21). Little information exists about the rest of the artifactual assemblage or subsistence due to a lack of protected stratified sites. Hall and Barker (1975), however, citing Jennings (1957:Table 21), suggest that a 280 percent increase of ungulate bones between Levels IV and V at Danger Cave may have resulted from the introduction of the bow and arrow. Hall and Barker (1975:60) argue that the decimation of big horn sheep in this period due to the bow and arrow is reflected in rock art (Grant, Baird and Pringle 1968:112-115).

The introduction of bow and arrow with attendant changes in projectile types may warrant distinction in local material-cultural chronologies, but does not necessarily indicate a significant change in ethnicity or tradition. It is questionable whether Rogers would have considered the East Gate/Rose Springs Complex as a late manifestation of Amargosa (III) or as early Yuman (cf. Non-Pottery Yuman, Rogers n.d.:field notes). The concept of Amargosa was revised both chronologically and conceptually by Rogers in Haury's Ventana Cave investigation (1950:Figure 116). This revision was not clarified prior to Rogers' death and has created some confusion. He intended to publish a manuscript clarifying the Amargosa concept, but did not (Drover 1979:17).

A number of significant changes occur in material and non-material culture of the Mojave Desert at approximately A.D. 1000. The changes are recognized as both typological and cultural (Rogers 1939:Plate 21, 1945; Wallace 1962:177; Hester 1973:127; Bettinger and Taylor 1974). Projectiles of this period are defined as Desert Side-notched (Baumhoff and Byrne 1959) and Cottonwood (Lanning 1963). Although the appearance of these projectile types is commonly equated with the expansion of Shoshonean groups, Rogers (1939:Plate 18) distinguishes between Early Desert Mojave (Cottonwood), Late Desert Mojave (Desert Side-Notched), and Paiute-Shoshonean (Side-Notched variant) projectile forms.

Ceramics, usually associated with the onset of the Late Prehistoric Period, probably appears earlier than A.D. 1,000. Three

or possibly four separate ceramic wares were manufactured in eastern California by at least A.D. 800. These technologies eventually became the historic pottery of the southern Paiute, riverine Yuman, and coastal Yuman groups.

Southwestern ceramic taxonomy and chronology is perhaps the most accurate of its kind due to early stratigraphic observations (Kroeber 1916; Nelson 1916) and more recent dendrochronological cross-dating. Early efforts to systematize prehistoric Southwestern ceramic knowledge resulted from the work of Hawley (1936) and, most importantly, from Hargrave (1932) and Colton and Hargrave (1937). As a result of the work initiated by Colton and Hargrave, most prehistoric ceramics from the greater Southwest have been identified and named. Western Arizona and eastern California were some of the last areas described (Dobyns and Euler 1958; Schroeder 1958) and remain the least understood. Malcolm Rogers appears to have had the most comprehensive understanding of eastern California ceramics, but did not formalize his ideas prior to his death in 1960. Many of Rogers' type names and descriptions were adapted by Schroeder in his Lower Colorado Buff Ware series (1958).

Three or four ceramic wares of three cultural traditions appear with enough regularity in southeastern California to have been produced there. Owens Valley Brown Ware (Riddell 1951) and Southern Paiute Utility Ware (Stewart 1942; Baldwin 1945) are the ceramic technologies of the southern Great Basin Paiute. They comprise two separate wares, though the latter may not have actually been produced in California (cf. Riddell 1951:22). Owens Valley Brown Ware extends from Las Vegas westward to Bishop, California, and beyond, where it is apparently the inspiration for late ceramics among the Plains Miwok and Yokut peoples of the southeastern Central Valley. Owens Valley Brown Ware has a wide geographic distribution, but may not have been produced much further south than Death Valley.

Lower Colorado Buff Ware is said to have been distributed mainly along the Colorado River (also Colorado Desert) between Hoover Dam and the Sea of Cortez beginning about A.D. 800, with probable affiliations with Pioneer Phase (pre-A.D. 700) Hohokam culture (Schroeder 1958). This ceramic sequence culminates with riverine Yuman groups, at least one series of which (Parker Red-on-Buff) developed into historical Mojave ceramics (Kroeber and Harner 1954). Pottery of this ware may have been manufactured as far west as the present towns of Barstow and Indio, California, and as far east as Gila Bend, Arizona. Temporal treatment of singular types is difficult without chronologically comparable riverine sites.

Certain gray and black-on-gray ceramics manufactured in the Mojave Sink and Halloran Springs regions may be related to the Virgin River Series of Tusayan Gray/White Wares or possibly to

Prescott Gray Ware (Rogers 1929; Drover 1977). They are associated with cultural foci in the Virgin and Muddy River drainages of southern Nevada (Tusayan Gray/White Wares) or the upland Patayan foci in northwestern Arizona (Prescott Gray Ware) which parallel major Anasazi (Colorado Plateau) cultural foci. These types, while probably not widely produced, correspond to Basketmaker II-Pueblo I time (A.D. 600-1,100). The ceramics are apparently related to Pueblo expansion and/or trade in the Halloran Springs (turquoise district) and Mojave Sink regions.

Tizon Brown Ware, originally named by Colton and Hargrave (1937) from specimens recovered during survey in northwestern Arizona, was subsequently described in detail by Dobyns and Euler (1958). Tizon Brown Ware, with a temporal range from A.D. 700 to 1,890, was made by:

> . . . upland Arizona Yuman Indians, principally the Walapai, and their direct ancestors of the Cerbat Branch [Patayan]. At least one type, Tizon Wiped, was a variation produced by the Havasupai (Dobyns and Euler 1958:Ware 15).

An apparent increase in habitation sites led Wallace (1962:178) to infer a larger population during the Late Prehistoric Period. Several authors have suggested that various groups experimented with agriculture during this time (Rogers 1929, 1945; Forbes 1963). A population increase and experimentation with agriculture may indicate climatic differences during the last millenium, a possibility that should certainly be explored more fully.

While it is widely believed that Shoshonean speakers (Southern Paiute) made their first appearance from the north during Late Prehistoric times, the local antiquity of the Shoshonean language family in southern California has been questioned (Broadbent 1976; Hall 1976; Koerper 1979). The ethnicity of Late Prehistoric archaeological materials in the Mojave Desert region has been a major concern to local prehistorians (Rogers 1945; Schroeder 1957) and poses problems dealt with in the present research.

Historic Period

Early European contact with indigenous American populations began in this region in A.D. 1540. The Spanish explorer Hernando de Alarcon in a party of small boats sailed up the Colorado River some distance beyond the Colorado-Gila confluence at the head of the Colorado Delta (Federal Writers Project 1939:63b). Although this contact was quite distant from the current study zone, it no doubt had an impact on the indigenous population throughout the Mojave as exploration continued.

Also in 1540, Melchior Díaz marched from Sonora toward the Colorado in search of Alarcon (Steere 1952). In the early 1600s Juan de Oñate marched downstream along the Colorado River, reaching the Gulf of California on January 25, 1605 (Norris and Carrico 1978:15). The accounts of the Colorado region were superlative; nonetheless, the Spanish government turned its attention elsewhere and the Colorado River and the vast lands to the California coast went unexplored and unnoticed for the next 170 years.

An expedition from Tucson to present-day Yuma and surrounding regions was led in 1771 by Father Francisco Garcés (Pourade 1960). This effort, coupled with the founding of Mission San Diego de Alcalá two years earlier, solidified the Spanish government's commitment to the colonization of Alta California. Between 1772 and 1776 the Anza/Sonora route was established, allowing transportation and trade between the California missions and the Arizona/Sonora region (Lindsay 1973; Pourade 1960).

The first recorded expedition to enter the Mojave Desert region was that of Garcés in 1775-1776. Moving northward along the Colorado, Garcés reached the area of Needles and headed westward with the aid of native Mojave guides (King and Casebier 1976:283-284; Bard 1973:38). Traveling a path forged and frequently used by Mojave traders and raiders between Paiute Valley and the California coastal plain (Norris and Carrico 1978:22), Garcés moved from watering hole to watering hole to sustain his pack animals, wagons, and mounted men. The trail led Garcés through the Providence Mountains to Soda Springs and beyond the Cady Mountains to the southern slopes of the Calico Mountains. There is no real mention of the Barstow area beyond these several brief passages:

> Mar. 16. Having gone four leagues I came to where there was good grass, large cottonwoods, cranes and crows of the kind there is at San Gabriel. Mar. 17. At the passage of the river the mule mired down and wetted all that he was carrying, and for this did I tarry there. This day I dispatched one Jamajab (mojave) and Sebastian, that they should seek the inhabited rancherias . . . This day came five Jamajab Indians who were returning from San Gabriel from their commerce, and very content to have seen the padres . . . Mar. 18. Sebastian returned without mishap, praising the kind reception that had been given them by the Indians whom they had seen; and thereupon I went five leagues southwest up the river, and arrived at a rancheria of some forty souls of the same Beneme nation . . . (Coues 1900).

Coues in his note places Garcés somewhere between Grapevine (latter-day Barstow) and Cottonwood, which is probably around Helendale.

By 1781, a native insurrection near Yuma and further south effectively closed (for a time) the Anza/Sonora trail to most travelers. More northerly routes from New Mexico to the California frontier were sought. Eventually, the Old Spanish Trail became the major trade route. The exact location and course are much in question (Hafen and Hafen 1954; Casebier 1975; Warren and Roske 1978), but there is no debate that the trail (or trails) became a busy commercial route between 1830 and 1848, used by merchants, emigrants, trappers, and thieves (Edwards 1969; Casebier 1975). The first American emigrants came over the trail in 1841 (Bard 1973:43).

When war between the United States and Mexico broke out, the Mojave Desert remained largely uncharted and little understood by Europeans. The Old Spanish Trail served as an immigrant trail, commercial road, and marauder's escape route. Natives still controlled the land; nature prevailed; permanent settlements and extended land use were several years and another culture removed from the sunset of the Mexican period in 1846 (Norris and Carrico 1978:29).

The American period (1846 onward) brought thousands of immigrants into California; their influence on the Mojave Desert region was profoundly different from the preceding Spanish and Mexican periods. American efforts focused on extracting and exploiting the available desert resources, pushing the indigenous people further to the side. With grazing animals destroying their food sources, settlers and immigrants claiming their springs and streams, and land being stripped from under them, the native populations reacted violently. By the late 1850s, a strong military presence was required to protect American interests from Indian hostilities. Fort Mojave was established during this period, as well as other outposts at Camp Sugar Loaf (near Barstow) in 1858, Camp Cady in 1860, and other localities along well-traveled routes. A redoubt was also built at Bitter Spring in early 1860 by Lieutenant Carleton, U.S. Army, who was in pursuit of a band of marauding Indians said to have murdered two drovers from Salt Lake (Casebier 1972:128; Kaldenberg 1981:18).

Once protection was reasonably assured, the way was open for civilian growth. Suppliers established outposts to serve the needs of travelers. Miners began to operate in previously undiscovered areas, settlements and ranches started to form, and transport and trade were greatly increased. Railway surveys conducted earlier (1853-1860) laid the groundwork for a large network of rail lines which, beginning in 1876 and flourishing through the early 1930s, played a major role in the development of industrial mining throughout the Mojave region.

During the late 1800s and early 1900s, a great deal of prospecting occurred throughout the Fort Irwin region. Claims were laid for the extraction of both metallic and nonmetallic ores. Borax was discovered in Death Valley in the 1880s, bringing the transport of large amounts of ore by mule team and wagon through Fort Irwin on the Old Borax Trail. This trail wound from Saratoga Spring to Cave Spring in Avawatz Pass, passed Bicycle Lake, and went through Garlic Spring on the way to smelters in the Barstow-Daggett area. Short-lived mining camps were established at Avawatz and Crackerjack around 1908, and Goldstone was active during this period (ca. 1910). These ephemeral mining settlements came and went with the economic tide.

By 1917 the American Automobile Club and the City of Los Angeles had hired a caretaker to reside at Cave Spring along the Barstow-Daggett/Death Valley road. A general store and gas station were eventually added. Caches of water, gasoline, and other essentials were placed along the routes for use by needy travelers (Moon 1980:personal communication).

Set against the prevailing pattern of American culture and influence, the native populations of the Fort Irwin region left their lands and were forced into set-aside government reservations or cultural obscurity as the nation moved into the twentieth century.

CULTURAL RESOURCE POTENTIAL

The historical and archaeological record of the Mojave Desert region clearly supports an inference of high cultural resource potential for the Fort Irwin Military Reservation. However, an understanding of prehistoric activities and behavior patterns for indigenous populations in this area remains unconstructed. Using ethnographic evidence, broad social concepts, wide-ranging cultural patterns, and paleo-environmental information, a hypothetical model of subsistence practices and activity patterns for the Fort Irwin area has been developed. Combined with the physiographic and environmental data presented in Section I, this reconstruction helps provide a more cohesive understanding of resource site interpretations presented in this report.

Most researchers agree that for perhaps the last 1,500 years, the territory surrounding Fort Irwin has been held by one or another group of the Shoshonean stock (Numic language speakers) of the larger Uto-Aztecan family (Kroeber 1925:578-580). However, in attempting to define the several groups and their territorial boundaries, consensus fades and boundaries are ambiguous. As noted by Kroeber, "The boundaries in this desert were certainly not straight lines, but for the present there is no recourse but to draw them" (1925:590, Figure 51).

Numic language speakers in this region during the Protohistoric Period (ca. 200 years B.P.) included Vanyume-Serrano, Kawaiisu, and Chemehuevi divisions. While the dialect and certain customs of each group certainly varied to some degree, the material culture and patterned adaptation to arid land environments were quite similar. A high degree of material culture homogeneity is evident:

> Basic items held in common are triangular arrowpoints, millingstones, handstones, and locally made pottery vessels . . . an assortment of crude service tools . . . and beads made from imported (coastal) seashells (Wallace 1962:117).

A far-reaching trade network and broad pattern of seasonal transhumance (Davis 1963) have also been inferred (Kroeber 1925:592; Wallace 1962:178) or ethnographically reported (Coues 1900) for the close of the prehistoric periods. It is notable that similar homogeneity has been deduced for earlier cultures or material complexes representative of the Early Prehistoric/Terminal Paleo-Indian periods (Jennings 1964; Swanson and Sneed 1966).

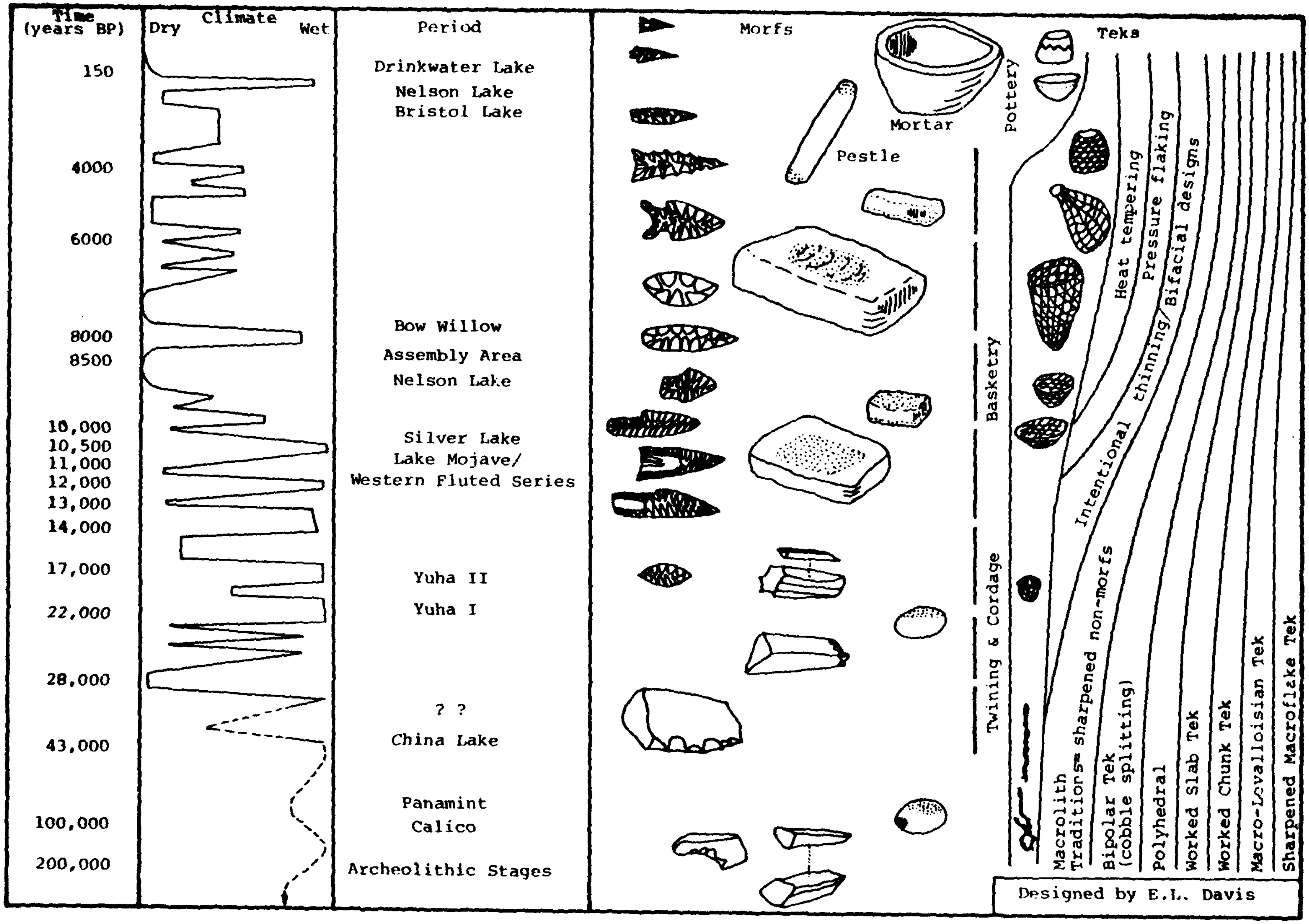
The basic similarities in material assemblages continues through time to much earlier periods, suggesting an as yet immeasurable relationship between social aggregates over a widespread geographic area (Table 2). Furthermore, this pattern may be worldwide, as evidenced by parallels between New World and Old World prehistories that are receiving greater recognition and scientific scrutiny (Carter 1978; Davis et al. 1978; Hayden 1981).

Research into paleoenvironment and paleoecology has been conducted by many diverse disciplines throughout the world, as the effects of climatic fluctuations and concomitant physiographic responses are felt worldwide. The bulk of pertinent paleoenvironmental data has been furnished by geological, geomorphological, and paleontological research, augmented by biological and archaeological information.

Most available paleoenvironmental data relates to world climatic conditions after the termination of the last major glaciation, that of the pluvial Wisconsin glacial retreat occurring roughly 10,000 years before the present (Shumway, Hubbs and Moriarty 1961; Smith n.d.; Curray 1960). Eustatic glacial behavior caused an abrupt rise in sea level and change in global air temperature and precipitation rates.

Many contributions to current knowledge have been provided from research conducted in the western United States (Antevs 1948, 1955; Axelrod 1948, 1979; Hubbs 1957; Morrison and Frye 1965; King 1976). The primary information sources which address paleoenvironment are based on palynology, ocean sediments,

Table 2: A RECONSTRUCTION OF SEQUENCES AND RELATIONS OF FORT IRWIN PREHISTORY



temperature, and water level data. Highly sensitive "precipitation/evaporation" (P/E) rate relationships in ancient inland lake systems, such as Lake Lahonton (Morrison and Frye 1965), Lake Mojave (Shumway, Hubbs and Moriarty 1961), and Lake Cahuilla (Waters n.d.), also add clues to past climatic conditions.

Geological characteristics of major land formations, such as pluvial flow systems (Shlemon 1982:personal communication) and high-intensity erosional features (Antevs 1952; Cooke and Reeves 1976; Aschmann 1959), provide suggested chronologies of climatic variability through time. Large-scale erosion relates to arroyo development, as described by Antevs:

> Arroyo erosion may have been caused by occasional high-intensity rains. It occurred when sharp enduring droughts had so reduced the vegetation cover and the associated plant litter and soil mantle that these were unable to retain or retard the water masses of sudden downpours, but permitted the water to rush off and to gather into raging torrents of great erosive power (Antevs 1952:377).

Arroyo building may be an important consideration for the Fort Irwin region as the present water regime, even in high precipitation years, is insufficient given present vegetation coverage to have formed the wide water-worn channels and canyons of this physiographic setting.

A brief review of the major climatic conditions which affected the southwestern United States and influenced land use strategies of aboriginal populations in the desert and mountain regions of southern California has been presented by Antevs (1948, 1952, 1955). He proposed that the post-glacial Holocene be divided into three major climatic stages caused by differing amounts of precipiation and ambient air temperatures. The beginning of the first stage, the Anathermal beginning 9000 to 7000 years B.P., is composed of a climate much like today, but growing warmer, probably subhumid and humid. The Great Basin lakes reached their maximum stand during this stage. The onset of the Altithermal approximately 7000 to 4500 B.P. brought hot and dry conditions, and the Great Basin lakes disappeared. The climate was distinctly warmer than today. The Medithermal stage, beginning approximately 2500 B.P. and continuing to the present, brought moderately warm, arid and semi-arid conditions, but distinctly cooler than in the Altithermal stage. The Great Basin lakes gradually gained low-level water tables, and water is visible in many after storms under present conditions.

Variations of this sequence have been proposed by numerous authors, such as Hubbs, who indicates that:

> Although the period between 7500 and 5000 years ago was almost certainly much drier than it had been before about 10,000 years ago, the climate in all probability was more moist than at present (1960).

Archaeological data which reflects variable climatic conditions have been critiqued by Baumhoff and Heizer (1965) and support Antevs' temperature sequences. They suggest that significant contributions to refine the current knowledge of climatic conditions and human responses and acclimation to environmental change should focus on two time periods, the onset of the Altithermal period and the onset of the Medithermal period.

Before attempting a paleoenvironmental reconstruction, general philosophical foundations must be established from which to structure and organize many diverse factors that operate in non-static and interrelated medium. Sarma (1977) notes that environmental reconstruction is fundamentally an ecological reconstruction that is processual in nature. He holds that the goal is to evaluate adaptive interaction between socio-cultural and ecological systems. Stini stresses that "all sorts of learned responses may be employed by humans to reduce the hazards of their environment" (1975:11). He emphasizes the human ability to acclimate to various amounts of change and notes that "It is also possible to respond to a single short term stress with physiological alterations of relatively modest dimensions. Such responses will utilize resources already present to correct an imbalance . . ." (1975:10). Stini further notes that successful acclimation relates to ". . . increased flexibility in selecting means to deal with the demands of a changing environment . . . viewed as adaptation through adaptability" (1975:12).

The degree to which human populations can continue to acclimate without irreversible cultural change is unknown; however, Renfrew (1978) notes that a culmination of gradual changes may cause sudden evolutionary effects. Such events tend to be expressed as residual evidence in the cultural historic and archaeological record.

The question of gradual changes as opposed to sudden shifts in paleoenvironmental conditions has been examined by numerous authors, including Weide (1976), who suggests that the magnitude of change during the challenging Altithermal period was relatively low, thereby allowing opportunity for acclimation and adaptation.

The additional problem of what truly constitutes a meaningful climatic change requires clarification. A reasonable definition is presented by Van Rudolph, which states:

> A climate change can be spoken of only when . . . the type of weather has so far changed in the area

> concerned that the makeup of vegetation, the water budget . . . and ultimately the fauna are materially changed. . . . After valid climatic change the typical climate of the former period shall only occur in exceptional circumstances (i.e., extreme cases which lie outside the normal variance of the new period). The extreme of (the) old period should no longer recur at all . . . The new climatic period should stretch over several decades (1956:12-34).

Given the above, large fluctuations from the "climatic norm" are possible without being considered true climatic change if overall normal climatic conditions are regained (Bryson 1974). During climatological situations where limited variance from the mean annual temperature and precipitation rates persist for measurable periods, a "steady state" (i.e., no cut or fill) exists which allows "true soil" or solum to form. Presence of these soil argilic formations aid in interpreting the geologic and petrologic history of differing physiographic settings and often provide information relating to paleoenvironmental reconstruction.

On a regional basis, shifts in climatic conditions have been documented as marked increases or decreases of precipitation rates. An example would be the last recession of Lake Mojave, dated to 9640 ±120 years B.P. by Shumway, Hubbs and Moriarty (1961:11). Many pluvial-related fluctuations in water levels have been noted in Searles Lake, including a slight rise occurring ca. 1800 B.P. (Smith n.d.). More recently, lacustrian intervals were recorded for Lake Cahuilla between 1250 to 1100 B.P., 1000 to 875 B.P., 700 to 550 B.P., and 470 to 370 B.P. (Waters n.d.). These are but a few recorded examples of variable climatic conditions that may have affected aboriginal populations in the western Great Basin.

For the Fort Irwin region, the question may well be whether the cultural system responsible for the archaeological deposits is an identifiable portion of some broad social continuum that gave rise to the protohistoric cultures first reported in this region by historical accounts and ethnographic records. If so, then models of subsistence practices and activity patterns constructed from the protohistoric era may be useful in interpreting the residues attributed to earlier prehistoric periods. Two recent studies which tend to support this approach have focused on issues of linguistic affiliation and migration in western North America (Krantz 1977:1-64) and technologic adaptation and cultural transition between Pleistocene and post-Pleistocene times (Bryan 1981:519-548).

Using the available data from protohistoric and ethnographic records for the southwest Great Basin and southern California region, a hypothetical model of subsistence practices and

activity patterns has been developed to aid interpretation of the resource sites discovered in the Fort Irwin area. The value of such a model rests on its ability to elucidate cultural inferences with reference to seasonal subsistence practices, migratory movements, settlement, and activity patterns associated with the cultural resource sites in question (refer to Section V).

For hunter-gatherers in the southwest Great Basin region, spring was the most active season (Table 3). Plant foods and game were abundant in all ecozones. Women and children primarily gathered and processed plant resources for food, medicine, and utilitarian purposes; however, men sometimes gathered and processed plants as well (Bean and Saubel 1972). In the recent past, these plants could be gathered from valleys and plains, foothills, and desert zones with elevations ranging from 2,500 to 7,000 feet (762 to 2,134 meters). Plant food resources gathered in the spring included the buds, fruits, roots, bulbs, seeds, and stems of the Joshua tree, *Echinocactus* and *Opuntia* sp., mesquite, yucca, and buckwheat (Bean and Saubel 1972; Zigmond 1981; Jaeger 1978; Hedges 1967).

Medicinal teas, solutions, poultices, and powders were obtained from the creosote bush, *Opuntia* sp., and buckwheat for a variety of ailments, including colds, infections, stomach cramps, cancer, open wounds, burns, rheumatism, poor blood circulation, headaches, and intestinal disorders (Bean and Saubel 1972; Zigmond 1981; Almstedt 1977; Krochmal et al. 1954; Jaeger 1978). In addition, plant materials were employed for utilitarian purposes. An infusion was made from creosote as a hair wash used to suppress dandruff and as an effective disinfectant and body deodorizer (Romero 1954:37). Barrows (1900) states that creosote was prepared and used to treat horses suffering colds or distemper. Creosote and mesquite provided an excellent source of fuel for cooking, heating, and for baking clay pots. Gum was extracted from these plants and used for mending broken pottery, waterproofing baskets, and as adhesive to fasten foreshafts to arrows and baskets (hoppers) to mortars (Bean and Saubel 1972; Zigmond 1981; Dodge 1978). Shadescale and spiny hopsage were employed in the manufacture of wooden arrow points that were attached to arrow shafts, taking advantage of their hardwood characteristics (Zigmond 1981). Sandals, nets, skirts, and other garments were fashioned from the fibers of mesquite and Joshua tree (Bean and Saubel 1972). Red dyes were extracted from the root stock of the Joshua, while black dyes were obtained from mesquite. Among their many uses, dyes were employed for patterning designs in coiled basketry (Zigmond 1981). Mesquite was also useful as construction material in manufacturing mortars, bows, and house frames (Bean and Saubel 1972).

While women gathered plants, men hunted and trapped large and small game to provide protein-rich food and for utilitarian implements. Larger animals were particularly valued because they

Table 3
HYPOTHETICAL MODEL OF SUBSISTENCE PRACTICES AND ACTIVITY PATTERNS IN THE FORT IRWIN AREA*

Activity	Labor Division	Flora/Fauna	Gathering Period	Use	Comments
SPRING:					
Gathering and processing roots, bulbs, seeds, stems, and blossoms	Women, children	Larrea sp. (creosote)	April, May	Medicinal Utilitarian	Mythological implications
	Women, children	Atriplex confertifolia (shadescale)	March	Utilitarian	
	Women, children	Grayia spinosa (spiny hopsage)	March	Utilitarian	
	Women, children	Yucca brevifolia (Joshua tree)	April	Food staple Utilitarian	Mythological implications
	Women, children	Echinocactus acanthodes (barrel cactus)	Early spring	Food staple	Buds and fruits
	Women, children	Opuntia sp. (cholla)	March	Food staple Medicinal	
	Men, women, children	Prosopis juliflora (mesquite)	April, May	Food staple Medicinal Utilitarian	Blossoms
	Women	Yucca schidigera (Mohave yucca)	April, May	Food staple	
	Women, children	Eriogonum sp. (buckwheat)	April, May, June	Food staple Medicinal	
Trapped and hunted small game animals	Men, women, children	Rodentia (desert rodents)	Seasonal	Food staple	Skinning of fauna generally performed by men
	Women, children	Lacentilia (lizards)	Seasonal	Food staple	
	Men	Serpentes (snakes)	Seasonal	Food staple	

Table 3
HYPOTHETICAL MODEL OF SUBSISTENCE PRACTICES AND ACTIVITY PATTERNS IN THE FORT IRWIN AREA*
(continued)

Activity	Labor Division	Flora/Fauna	Gathering Period	Use	Comments
	Men, boys	_Sylvilagus audubonii_ (cottontail)	Seasonal	Food staple Utilitarian	
	Men, boys	_Lepus californicus_ (jackrabbit)	Seasonal	Food staple Utilitarian	
Hunting of large game animals	Men	_Odocoileus hemionus_ (mule deer)	Seasonal	Food staple Utilitarian	Often hunted by a single hunter
	Men	_Ovus canadensis_ (mountain sheep)	Seasonal	Food staple Utilitarian	
	Men	_Antilocarpa americana_ (pronghorn antelope)	Seasonal	Food staple Utilitarian	
Processed various foods for storage	Communal effort				
SUMMER:					
Gathering and processing seeds, bulbs, roots, etc.	Women, children	_Juniperus californica_ (California juniper)	June	Food staple Utilitarian	
	Women, children	_Asclepias subulata_ (milkweed)	August	Food staple Medicinal Utilitarian	
	Women, children	_Atriplex_ sp. (saltbush)	July, August	Food staple Utilitarian	
	Women	_Ephedra nevadensis_ (squaw tea, Mormon tea)	Late summer	Medicinal	
	Men, women, children	_Prosopis juliflora_ (mesquite)	Early summer	Food staple	Pods
	Women	_Typha latifolia_ (cat-tail)	June, July	Food staple Medicinal	Ceremonial mats

Table 3
HYPOTHETICAL MODEL OF SUBSISTENCE PRACTICES AND ACTIVITY PATTERNS IN THE FORT IRWIN AREA*
(continued)

Activity	Labor Division	Flora/Fauna	Gathering Period	Use	Comments
	Women, children	_Pinus monophylla_ (pinon)	August	Food staple Utilitarian	
Trapped and hunted small game animals	Men, women, children	_Rodentia_ (desert rodents)	Seasonal	Food staple	
	Men	_Serpentes_ (snakes)	Seasonal	Food staple	
	Women, children	_Lacentilia_ (lizards)	Seasonal	Food staple	
	Men, boys	_Sylvilagus audubonii_ (cottontail)	Seasonal	Food staple Utilitarian	
	Men, boys	_Lepus californicus_ (jackrabbit)	Seasonal	Food staple Utilitarian	
Extended hunting expeditions	Men	_Odocoileus hemionus_ (mule deer)	Seasonal	Food staple Utilitarian	
	Men	_Ovus canadensis_ (mountain sheep)	Seasonal	Food staple Utilitarian	
	Men	_Antilocarpa americana_ (pronghorn antelope)	Seasonal	Food staple Utilitarian	
Processed various foods for storage	Communal effort				
FALL:					
Gathering and processing of seeds, roots, tubers, etc.	Women, children	_Eriogonum fasiculatum_ (California buckwheat)	September October November	Food staple Medicinal Utilitarian	
	Women, children	_Atriplex_ sp. (saltbush)	September	Food staple Utilitarian	Soap

Table 3
HYPOTHETICAL MODEL OF SUBSISTENCE PRACTICES AND ACTIVITY PATTERNS IN THE FORT IRWIN AREA*
(continued)

Activity	Labor Division	Flora/Fauna	Gathering Period	Use	Comments
	Men, women, children	*Prosopis juliflora* (mesquite)	Seasonal	Food staple Utilitarian	
Communal rabbit drives	Communal effort	*Sylvilagus audubonii* (cottontail)	Seasonal	Food staple Utilitarian	
	Communal effort	*Lepus californicus* (jackrabbit)	Seasonal	Food staple Utilitarian	
Hunting of large game animals	Men	*Odocoileus hemionus* (mule deer)	Seasonal	Food staple Utilitarian	
	Men	*Ovus canadensis* (mountain sheep)	Seasonal	Food staple Utilitarian	
	Men	*Antilocarpa americana* (pronghorn antelope)	Seasonal	Food staple Utilitarian	
Stored food resources for winter	Communal effort		Seasonal		
WINTER:					
Major social activities of the year	Communal		Seasonal		Social interaction Reciprocity
Trapped rodents, lizards, and other small animals	Men, women, children	*Rodentia* (desert rodents)	Seasonal	Food staple	
	Generally women and children	*Lacentilia* (lizards)	Seasonal	Food staple	
	Men	*Serpentes* (snakes)	Seasonal	Food staple	
Hunted large game animals	Men	*Odocoileus hemionus* (mule deer)	Seasonal	Food staple Utilitarian	

Table 3
HYPOTHETICAL MODEL OF SUBSISTENCE PRACTICES AND ACTIVITY PATTERNS IN THE FORT IRWIN AREA*
(continued)

Activity	Labor Division	Flora/Fauna	Gathering Period	Use	Comments
	Men	_Antilocarpa americana_ (pronghorn antelope)	Seasonal	Food staple Utilitarian	
Survival by whatever means possible	Communal effort		Seasonal		

*Based on ethnographic data provided by the following authors: Bean (1974), Bean (1978), Bean and Saubel (1972), Davis (1965), Heizer and Elsassar (1980), Jaeger (1978), Shipek (1970), Zigmond (1981).

provided much food and because these animals could be found throughout most of the ecozones during the spring season (Bean 1974). Large game included mule deer, mountain sheep, and pronghorn antelope. Small game, sometimes trapped with the aid of women and children, also supplemented the aboriginal diet. These included desert rodents, lizards, snakes, tortoises, quail, and rabbits.

Large animals were killed with the bow and arrow or clubs and partially butchered on the kill site for portage back to the primary camp or village (Bean 1974). Small game was captured with hooked sticks or trapped and clubbed to death (Bean 1974). The hides of some animals provided blankets and other articles of clothing, bones were utilized for tools, and tortoise shells were used in the manufacture of household utensils and ceremonial rattles (Bean 1974).

During the summer women and children continued to collect and process juniper and mesquite. Milkweed, saltbush, squaw tea, and cat-tail were also available during this season. Given the existing climatic conditions, these additional resources were obtained from ecozones between 2,000 and 5,000 feet (610 to 1,524 meters).

Milkweed was applied medicinally to warts; fibers from milkweed stems were made into cordage to construct snares, slings, and nets (Bean and Saubel 1972; Jaeger 1978). Squaw tea and cat-tail were used medicinally and as a source of food (Bean and Saubel 1972; Chase 1919; Palmer 1878; Romero 1954). Stalks from the cat-tail were sometimes woven into mats for ceremonial purposes (Bean and Saubel 1972).

In August, the aboriginal populations probably traveled to the pinon forests below 6,000 feet (1,829 meters) to harvest and process nuts. While women and children collected the cones, men hunted deer, squirrels, and birds, animals that competed with man for this valuable food supply (Bean 1974).

Throughout the spring and summer a communal effort was undertaken to process and store various food resources for the leaner months ahead. Buds and fruits were eaten raw or, if sun-dried and cooked, were stored (Zigmond 1981; Bean and Saubel 1972). Seeds, bulbs, nuts, and roots were ground into flour on a metate with a mano or crushed in a mortar with a pestle. The foodstuffs were stored in ollas and baskets or in a communal grainery (Heizer and Elsasser 1980; Bean and Saubel 1972; Zigmond 1981; Balls 1972). Game was skinned by men and cooked by women (Bean 1974). Meats were broiled on hot coals or baked in earth ovens. Sometimes after being baked, the meat and bones were pounded in a mortar and either eaten at that time or stored for later consumption (Sparkman 1908).

During the fall, buckwheat, saltbush, and mesquite were still gathered and processed. Game was available in the forested areas, meadows, and desert scrub communities (Zigmond 1981; Bean and Saubel 1972; Bean 1974). Rabbits, found in most of the life zones, provided an abundant source of meat during these months. Although rabbit hunting was a daily activity for men and boys, large-scale hunts were organized in the fall and men, women, and children participated (Bean 1974).

Winter was a lean time of the year. The aboriginal population relied primarily on stored food during these months; however, antelope were available in the winter when fresh plant foods were scarce and mule deer could be found in the chaparral-covered slopes and rocky canyons (Bean 1974:57). Since hunting and gathering activities were limited during the winter, large groups of people came together for ritual purposes and social interaction (Bean 1974).

Tool manufacture and maintenance were no doubt year-round activities, as technologic adaptations were necessary to successfully exploit most resources. Creosote, saltbush, buckwheat, and grasses could be extracted with simple flake-based tools or possibly by hand. However, some plants required specialized instruments, such as hafted planes or scrapers, digging sticks, or shovels to extract usable portions from the plants. Food processing required a variety of tools for pounding, grinding, shaving, drying, or heating. Tools are an obvious element of subsistence practices and may be recognizable as correlates to particular activity patterns associated with extraction of raw material for tool manufacture, maintenance behaviors, and subsistence uses.

Upon close examination, the Fort Irwin Military Reservation was highly suitable for Native American occupation and use. It contained a variety of native plants and animals that could be exploited by its inhabitants.

Lithic resources for stone tool manufacture are still quite common in the study area, and dikes and veins of chalceodny (locally called chapanite), low-grade chert, and metavolcanic rock are scattered throughout the territory probably inhabited by Native Americans. Cobble formations which could have provided suitable material for grinding stones (manos) can be found in streambeds and nearby geologic formations. Rock overhangs and natural rock shelters would have provided living chambers, mediums for art forms, and temporary shelter from the elements.

A dependable water supply was a primary factor in selecting living areas and campsites. Besides use as a life-supporting fluid, water was also used to soak plant fiber during preparation both for food and construction resources. The presence of water also had a direct effect on the type and quantity of plants

within a given area and served as an attraction to animals, thus increasing the chance of native hunters finding game.

Water availability and retention in the nearby Drinkwater and No Name Playa basins, combined with the rate of evaporation, would have made the shallow lakes inhabitable only at optimal periods and seasons. While the physiography of this region currently supports an arid to semi-arid environment, geoclimatic evidence indicates an earlier, moister climate (roughly 8,000 and 8,500 years ago and, earlier, 10,000 to 12,000 years ago), creating an ideal habitat situations.

In summary, the region could have served as a vast resource area that was probably exploited by indigenous peoples on a regular basis depending on the available foodstuffs, lithic resources, and water supply. It is suggested that an exploitation pattern such as this is responsible for archaeological sites indicative of temporary camps, food processing, stone tool manufacture, and seasonal occupation.

SECTION III

GOALS, RESEARCH STRATEGY, AND PROGRAM DESIGN

The U.S. Department of Interior, National Park Service, Interagency Archeological Services Division, requested the preparation, performance, and documentation of an intensive inventory program designed to discover, evaluate, and investigate the cultural resources contained within several portions of the Live Fire Maneuver Range. While the criteria for resource evaluation are a matter of Federal statute (36 CFR 60.4) and the intensity or level of investigation is established by common practice and professionally accepted guidelines (McGimsey and Davis 1977:66-71), the program designed to achieve these aims is frequently left to the researcher. For this reason, it is incumbent upon the practitioner to explicitly state each project's goals, research strategy, and program design.

The primary goal of the research presented here is to provide sensible, reliable information regarding cultural resources within portions of the LFMR and to describe their relationship to prehistoric culture patterns of the southwestern Great Basin in general and the Mojave Desert and surrounding environments in particular. Achievement of this goal must be measured by both the degree to which new information gathered from this research is directed at the notable lacunae in this region's prehistoric cultural research data base and by the degree to which this effort is documented and shared with other interested researchers and the general public. Satisfaction of this primary goal ensures that the purpose of the IAS solicitation--to inventory portions of the LFMR, investigate cultural resources therein, and evaluate resource potential--will be fulfilled in an efficient and professional manner.

OBJECTIVES AND ASSUMPTIONS

Several objectives have been established to guide and focus the design and direction of the present research. Fundamentally, archaeological research is best aimed toward: 1) learning the nature of the remains under study and the manner of their deposition, 2) reconstructing the nature and development of the social aggregate that produced the remains, and 3) discovery of the processes and factors affecting human development. The main objective has been to identify, analyze, and document the cultural record presented within the several study zones and to use these data to test hypotheses to achieve those fundamental aims.

An outline of lower echelon objectives was necessary to achieve stated aims. These are as follows (after Weide 1973:5):

1) Discover the range of resource variability within the several study zones

2) Identify areas of greater or lesser activity by past human occupants of the study zones

3) Determine the kinds of activities performed by past human occupants of discovered resource sites

4) Recognize and elaborate on patterns of past human use and occupation of the area

5) Formulate and assess the environmental or cultural variables, or combination of variables, that present the most reasonable explanation for occupation of this zone.

To fulfill these objectives, several basic assumptions were made. First, it was assumed that in periods of past human activity in this region (and in the occupation of these sites in particular), human behavior was a patterned response to physical and cultural needs and that fulfillment of these needs was significantly affected by environmental factors outside human control. Secondly, it was assumed that the economy of resource extraction was an important determinant of land use patterns practiced by indigenous populations (Weide 1973:6) and that this system was well developed into a network of trade, industry, and seasonal transhumance at the time of historic contact. Thirdly, it was assumed that the cultural system responsible for the deposits is an identifiable portion of the broad Desert Archaic traditions that preceded the protohistoric cultures first recorded in this region by historical accounts and ethnographic records. Finally, it was assumed that the pattern, purpose, and association of the deposits may be determined or known through a sample investigation of less than the total assemblage.

THEORETICAL ORIENTATIONS

It is necessary to clarify some of the components of the theoretical approach underlying this research. A proper theoretical orientation serves to narrow the research to a manageable scope and to facilitate its pursuit (Kowta 1976:6).

Program methods and documentation for data collection in the current study are outlined in Section IV of this report. Briefly, information was gathered in a controlled fashion from resource sites, loci, and features found in the study zones through the application of intensive surface survey techniques and limited supplemental testing methods. Theory was directed at the system of principles, practices, and procedures applied to intensive archaeological field investigation, analysis of re-

covered data, and the generation of hypothetical explanations that can be tested at some later date.

Theoretical orientation is also important when developing cultural sequences. All new discoveries are interpreted within the context of existing data. The kind and number of resources expected in the study zone are a function of the theoretical orientation. Although tentative and somewhat hypothetical, the existing interpretation of local cultural sequences greatly affects interpretation of new discoveries. The classification schemes and avenues for special study presented in a subsequent subsection (Definition of Primary Terms) are theoretical outgrowths from existing information gathered from the study of other arid lands resources in the southwestern Great Basin region.

In addition to theoretical orientations that guide the collection and analysis of data pertaining to the specific resources in question, certain theoretical propositions were used to construct a body of theory which, assuming proper validation, may eventually be used to explain the resources. These propositions are more or less useful to the degree that they:

a. Refer to abstract rather than concrete phenomena.
b. Relate otherwise discrete phenomena in previously unsuspected ways.
c. Encompass more phenomena in more economic fashion.
d. Generate additional propositions through logical deduction or permit a larger variety of predictions (Kowta 1976:8-9).

<u>Proposition 1</u>. The basic unit of behavior inferable from an archaeological context is the activity. Activity is the interaction between at least one energy source and one cultural element (Schiffer 1972:157).

<u>Proposition 2</u>. Units of activity (and their elements) represented in an archaeological context may be grouped as activity sets consisting of all activities repetitively performed within a specific unit of space (Struever 1968:135), commonly called a locus (Binford 1964).

<u>Proposition 3</u>. Activity sets represented in an archaeological context may be grouped by activity structure, which is defined as all activities and activity sets participated in by an aggregate of cultural elements, termed a social unit.

<u>Proposition 4</u>. The aggregate of activity structures presented in an archaeological context represents a portion (or portions) of the prevailing socio-cultural system. This system may

be explained by: 1) understanding the nature of observed activities, activity sets, and structures by which the socio-cultural system is maintained; 2) determining the independent environmental variable or variables with which the socio-cultural system must interact; and 3) identifying those factors or combination of factors responsible for observable temporal differences that reflect socio-cultural evolution over time.

JUSTIFICATION OF PROBLEM SELECTION

The primary focus of the current research was discussed earlier (Section I) and is briefly iterated here. Contract requirements specify that the researchers locate and identify the cultural resources within the several study zones and that they evaluate these resources for possible eligibility for nomination to the National Register of Historic Places (36 CFR 60.4). To fulfill these requirements, Cornerstone Research undertook an accurate and intensive surface assessment of each resource site reported, paying particular attention to cultural and chronological associations, resource variability and extent, and the potential for the resource to add significantly to an understanding of this region's prehistory.

More complex problems, or issues of greater detail, might certainly be justified; however, the content of existing information regarding the resources in the several study zones has been too insubstantial to support detailed interrogatories. The problem selected here is one of inventory and assessment, justified on the basis of need for additional information to more efficiently and accurately plan the appropriate mitigation.

DEFINITION OF PRIMARY TERMS

Implementation of this strategy and program design resulted in the identification and description of physical information, partial assemblages, and observed data from the numerous sites, loci, and features studied. These were later laboratory processed and specifically analyzed to support evaluations of determination of eligibility. The total effort is sufficiently complex that the definition of certain primary terms is warranted. Differentiation of sites and isolates, limited testing procedures, chronological determinations, and classification schemes are outlined below.

Differentiation of Sites and Isolates

Guidelines for the designation of site versus isolate were prepared by the U.S. Department of the Interior, National Park Service, Interagency Archeological Services Division, to aid in distinguishing sites from isolates in the current project

(provided in Appendix B) (Interagency Archeological Services 1981). These guidelines were expected to heighten the efficiency of the field effort by enhancing the accurate locating and recording of resource sites throughout the LFMR study area (Dean 1981:personal communication); resources whose significance does not warrant positive determination of eligibility might be more readily recognized and the recording procedures modified appropriately. For this outline, a site is defined as the remains of past focused human activity; an isolate is an item or items dropped or discarded with no evident, direct relationship to focused human activities (i.e., a site).

It was found that, to a certain extent, the IAS guidelines follow generally accepted archaeological field methods and determinations. However, experiential field judgements concerning cultural resource distribution and content were also necessary to fully define a cultural resource as a site or an isolated phenomenon. For example, a core reduction station containing a limited number of flakes and cores might be better defined as a locus or activity center (site) versus an isolate. Additionally, the cluster designation appeared to have limited functional use when defining a cultural resource. Cornerstone Research therefore used the site/isolate guidelines as a basis for defining the cultural resources encountered in the field, but supplemented and refined these definitions based on field determinations of the overall material constituents present at a cultural site.

To aid in the identification of a site, the following criteria were used:

1) Midden: Midden should be discernible, with evidence including unnaturally darkened soils, ash or charcoal-laden soils, cultural subsurface items, or recognizable vertical cultural stratigraphy.

2) Multiple Class Artifacts/Density: At least three classes of artifacts should be evident, such as flakes/debitage, cores, utilized flakes, flaked lithic tools (including points and blades), ceramics, milling implements (including handstones and metates), bone or wood implements, decorative items (e.g., shell or stone beads, pendants), or other cultural ecofacts (e.g., miscellaneous shell or modified bone). At least twenty items within a ten-meter radius are required, barring any special and explicit justification for a lesser density.

3) Significant Features: Included here are hearths, structural remains, rock rings, alignments and cleared circles, trails, cairns, geoglyphs, rock art, inhumations or cremations, and nonportable items.

4) Area/Density: Twenty or more cultural items within a ten-meter radius, of any artifact class, should be included.

If one or more criteria are identified, the resource is designated a site. If one or more sites are designated in proximity and appear to be associated within a greater site, they may be designated as loci. The locus/site designation must be thoroughly justified and each locus described in the site documentation.

If no criteria are met, the resource may be designated an isolate. If, however, no criteria are met, yet the resource contains greater or equal to thirty items within a twenty-meter radius, the resource may be designated a locus and then subject to further definition. If one or more loci are located within thirty meters of the first locus' outer boundary, the loci may be designated a site. Again, locus/site designation must be thoroughly justified.

Accurate mapping and locating each resource aided in designating site versus isolate. Briefly, these included the use of large-scale aerial photographs, magnified (x8) and mounted on backboards to facilitate field use (provided courtesy of the U.S. Army, NTC, and U.S. Department of the Interior, IAS), and in already identified resource site zones, small-scale plat maps prepared for precisely this purpose through the network instrument mapping program. Once the site/isolate designation had been determined, documentation and recording activities were undertaken (refer to Section IV).

Limited Testing Procedures

Procedures considered for use as limited testing techniques are primarily small-scale subsurface inspections of several kinds. Test excavation units, exposed profile analyses, and straticuts were applied in the current limited testing program.

Test excavation units are controlled subsurface samples useful in determining potential for the presence of buried cultural debris. They may be rectangular, elbow, or square. All materials and soils removed from the unit are screened through one-eighth-inch mesh hardware cloth and closely scrutinized for cultural material. Features and select items observed in the unit are mapped in situ and recovered with all pertinent contextual detail. Test units are excavated to a minimum depth of fifty centimeters in the absence of a subsurface cultural deposit; positive subsurface findings may require excavations to a greater depth. Due to subsurface physiography, mixed results materialized during this study regarding depth of excavation. Representative sidewall profiles are compiled; and the test units are photographed prior to backfilling.

Exposed profile analyses and straticuts are two techniques conducted for limited tests and geomorphologic inspection of selected cultural resource sites. Exposed profile analysis consists of facing-down existing exposed terraced regions in the eroding wash zones that cut the stable alluvial surfaces in this region and analyzing, documenting, and recording their stratigraphic records. Analysis of stratigraphy is expected to aid geomorphological assessment. These exposures potentially provide subsurface cultural data as well, although positive occurrence is yet to be verified. Straticuts--cut to a size roughly one by one-third meter to a depth of some fifty centimeters--offer a more limited zone of inspection within the resource site. While the exposed profiles are not as subject to limitations with regard to profile area, the straticuts are less restricted in location and, in fact, may be placed anywhere an initial profile inspection is warranted. With the discovery of any subsurface cultural debris, focus of the limited test shifts to incorporate the archaeological methods of excavation and observation proposed for test unit excavations. Geologic data are recorded--in any event--as discussed for other limited test procedures referred to above.

Chronological Determinations

In all facets of cultural reconstruction or archaeological research, chronology is an obvious and fundamental factor. To discuss cultural systems and their variety or distribution, it is necessary to control for change over time. Although the chronological factor is well recognized, it is also highly elusive. Many techniques are frequently applied in the quest for a chronology of observed cultural manifestations. Relative dating techniques far outweigh absolute dating techniques in sheer number of both methods and application. Relative or indirect chronological techniques applied in this region include stratigraphy, artifact seriation, the use of horizon markers (temporal types), cross-dating, geochronology, paleontology, obsidian hydration, and fluorine and nitrogen tests (Hester 1973:7). Absolute or chronometric methods include the widely used radiocarbon technique and other, more complex and sophisticated physiochemical techniques, such as potassium argon, thermoluminescence, and paleo-magnetic dating (Hester 1973).

In previous study, temporal types, artifact seriation, and geoclimatic indications were used for preliminary assessment and indirect chronological determination (Davis, Eckhardt and Hatley 1981). The use of relative dating techniques has led to statements and inferences--the latter, mainly--regarding the periodicity and function of the resource sites in question (Davis, Eckhardt and Hatley 1981; Hanna et al. 1981). These measures, while entirely adequate for the preliminary inventory and assessment phases of research, need to be supplemented when greater reliability or more intensive investigation is required. For any

future data recovery investigation, several programs of special study should be initiated to add greater clarity and supportive data to statements made regarding the resource sites. These would include, but would not necessarily be limited to, experimental replication of flaked stone artifact manufacture, geomorphological reconnaissance and geochronological interpretation, and physiochemical chronometric techniques.

Classification Schemes

Analysis and evaluation of the cultural resource inventory for this portion of the Fort Irwin Reservation consisted of two explicit phases or stages in the archaeological process: description and analysis. As integral parts of any adequate cultural research, these steps required that raw field data (e.g., recorded artifacts, contextual information, and limited recovered assemblage) be scrutinized in an attempt to generate conclusions about the specific cultural systems involved and, more importantly, universals concerning human behavior. To bridge the gap between singular existential statements, which are the descriptions of individual artifacts and their attributes, and conclusions, inferences, and explanations about cultural systems, it was necessary to introduce a classification procedure.

Classification is the foundation of data analysis in archaeology, and it is largely on the basis of raw data classification that inferences are made (Read 1974:216). Archaeological inferences are based on patterning of data, derived in the main from artifacts and activity residues assumed to be the result of patterned behavior and activities of human beings through time and space. Classification necessarily involves explicit definition of typologies in terms of assumptions about patterning among variables that result from different artifacts being manufactured, used, and disposed of in the course of varying activities.

Research objectives determine exactly the kind of patterning to which the archaeologist's classification system must be sensitive. Thus, there is no best analytical scheme for typological studies. Each classification should be designed to solve particular problems; accordingly, the attributes selected for measurement must be sensitive to significant variations in the assemblage (Redman 1973:10).

In archaeology, researchers normally deal with the discarded tools, equipment, and activity residues of early historic or prehistoric peoples. These material remains (or artifacts) are the focus of study, and the basic unit of classification is termed a "type." Type is an abstract construct created to facilitate analysis by grouping a number of items whose traits or distinctions are similar and that share the kind of attributes recognized and selected for the specific problem at hand. Most commonly used typologies distinguish between morphological types,

functional types, temporal types, and technological types; however, many typologies actually include a number of different classificatory constructs.

Morphological types are the most basic artifact type used in archaeology, involving the explicit definition of each artifact's morphological (i.e., formal) attributes. Although in its purest state morphological typology is simply descriptive in nature, in practice it is often a combination of attributes relevant to temporal and functional determination of the artifact's classification.

The method for determining functional types involves selection of attributes functionally related to the artifact's manufacture and use, such as edge angles, weights, striations, flake scars, or polish. Functional analysis is dependent on ethnographic analogy, experimental archaeology, and microscopic examination for accurately determining aboriginal usage. Overall, functional typology is considered one of the best and most useful classificatory schemes in archaeology.

A temporal type is a set of one or more morphological types with a fixed and known range in time (Thomas 1974:10). Temporal classification schemes attempt to establish a set of time markers, or morphological types known to have a certain assigned temporal range. Most of the early typologies, such as those of Malcolm Rogers, are quasi-temporal in nature. As more precise dating techniques became available, the use of temporal typologies was refined.

Technological types derive from attempts to determine procedures used to manufacture implements through examination of both the implements and manufacturing residues. In terms of flaked stone tool classifications, this means all flaked stone, including debitage (Sheets 1975:371). Technological analysis distinguishes the end products or finished tool types from other steps in the manufacturing process, thereby avoiding the error of assigning unfinished specimens to a type at the same level of contrast as types composed of finished artifacts. This is especially problematic when examining various stages of biface reduction (i.e., preform versus implement stage).

Just as there are various kinds of typological classifications from which inferences may be drawn, there are also differing levels of classification. The most appropriate level of classification for the current study involves the division of artifacts into provisional categories. However, these must be supported not only by well-reasoned and adequately defined subsets within each category, but also through the classification of pertinent contextual data. This information permits inferences about differential site use in terms of cultural activities such as resource procurement (sustenance and material), settlement

patterns, and stone tool manufacture, maintenance, and use. Under appropriate guidance, these inferences and the underlying provisional categories may be thoroughly tested by more rigorously inspecting the resource sites at hand.

Several objectives guided this analysis and the classification of lithic artifacts reported and, in some instances, recovered from the resource sites under study. Classification was employed to simplify description. Since it was not feasible to individually describe every artifact, items were grouped into provisional categories and those categories described. This is a primary objective of any preliminary analysis and is considered one of the main reasons for using classification schemes.

Secondly, assuming a group sharing a common culture will manufacture similar artifacts, one aim of classification is to identify the cultural or ethnic group with the artifacts they crafted and used. Although this is a major objective of the present study, it should be noted that there are many problems encountered with any complex classification approach; therefore, it should be constructed with extreme caution.

The final guiding objective is to isolate chronological indicators. Much research and synthesis of Great Basin projectile point styles has previously been conducted, thereby allowing refinement and a redeveloped understanding of the chronology, seriation, and regional distribution of these temporal types. This is of particular concern in this analysis since no organic samples suitable for radiometric dating were recovered, and the appropriate classification may isolate these broad temporal markers.

It should be emphasized that this provisional artifact classification scheme is preliminary only, where the primary objective has been to generate a limited quantity of data and hypotheses that may be tested at a future date. An attempt is made to use varying kinds of analytical techniques and methods that maximize information about the cultural system from readily available data. This results in some strong inferences that may be justifiably made from the data, as well as a series of tentative conclusions and hypotheses about specific topics that are conjectural. No single analysis or research project can touch on all the possible archaeological topics, nor should it necessarily be attempted, especially in an initial inventory and resource assessment phase.

The classification system used in this study involves distinguishing five broad classes of data (and their subsets) arising from the current investigation, including provenience, material class, material type, artifact class, and provisional artifact type. Classes and their constituent elements are then considered in comparison with existing information, from which

inferences regarding the type, function, and temporal associations of the various resource sites may be generated.

Provenience is important in collecting and controlling contextual data related to cultural resource sites and their contents. It has numerous aspects, including the location (elevation, physiographic position, inter- or intrasite situation), condition (state of deposition--primary or secondary--, degree of weathering or chemical alteration), and circumstance (manner of discovery--controlled surface sample, subsurface excavation sample, or random surface recovery) surrounding each item (artifacts, features, loci, or sites).

Material class as an element of classification is most useful in sites protected from the elements (e.g., shelters and caves) or deep midden deposits where a broad range of material remains may be expected. In the Mojave Desert region, this might include lithic, ceramic, faunal, and floral material classes. In the current investigation, the only material class recorded is modified lithic, requiring but a single category for this classification.

Material type categorizes or subdivides material class and aids in the discovery of varieties that may or may not be culturally induced. In some cases, this classification may result in recognizing sources of manufacture (e.g., ceramic) through categories or subsets classed by method of manufacture or material constituents. But in the present case it details the lithology (rock type) of the artifacts and presents (in concert with provenience) the ratio, variety, and distribution of rock types used and modified at the several resource sites and their various loci. Several common elements of the various subdivisions of this classification are presented below. These represent those types most commonly found as modified and altered forms in prehistoric resource sites in this region of the Mojave Desert.

Rhyolite. With a relatively light-colored groundmass, rhyolite occurs locally in such colors as green, grey, red-brown, purple, and tan. In porphyritic varieties, the phenocrysts are quartz and felspar. Nonporphyritic varieties may be difficult to distinguish from andesite, as they may display similar although somewhat darker colors.

Andesite. Intermediate in color between rhyolite and basalt, porphyritic varieties have no quartz phenocrysts. Nonporphyritic varieties tend to have a sugary texture and mottled appearance.

Basalt. This stone is relatively dark in color, with black and grey common. Local basalts may have a greenish tinge and

there may be phenocrysts of a green mineral, olivine, in the groundmass.

Felsite. This is a catchall term used to designate any volcanic rock not readily identifiable. Chemically, felsite ranges from rhyolite to andesite, but the term has come to focus on any groundmass of rather fine-textured, green to greenish brown volcanic material with a high quality conchoidal fracture. Some felsites are very fine grained with a waxy to vitreous luster not unlike chalcedony. Other felsites lack such luster, but still retain their conchoidal fracture qualities. Felsite, as classed here, does not occur in porphyritic varieties.

Quartzite. This metamorphic rock is distinguished by a sugary texture, commonly a vitreous luster, and a less well-developed fracture than many other rock types exploited by prehistoric peoples. Quartzite essentially consists of cemented grains of quartz and can be distinguished from sandstone because quartzite fractures pass through the constituent grains and sandstone fractures do not. Local quartzites are tough and dense, frequently found in cobble float or beds, and are white, grey, tan, red, brown, and black.

Chalcedony. This category includes specimens which might otherwise be known as agate, jasper, chapanite, and chert and is recognized by its fine-grained texture, waxy to vitreous luster, and quality of conchoidal fracture. Chalcedony is a noncrystalline variety of quartz for which color is a nondiagnostic attribute. Chalcedonies reported from local prehistoric resource sites vary in size, shape, and color, ranging from translucent, white, pink, red, brown, and tan to innumerable combinations of some or all of the spectrum. All petrified woods, for convenience, are also included in this type.

Obsidian. This natural glass has the highest quality of conchoidal fracture among those listed and is distinguished by its dark grey to greyish blue and black color, as well as its vitreous luster. Obsidian may occur with or without phenocrysts and is the chemical equivalent of rhyolite.

The remaining two classes used in this system of classification are "artifact class" and "artifact type." These are interrelated to the same degree as the material class and type discussed above. Artifact class is the rubric included in which are assemblages of provisional artifact types occurring in the several resource sites presently under discussion.

Artifact class as an element of classification assists researchers in deciphering what physical properties and modes of alteration were employed by those responsible for the cultural deposition at a given site. Such data are useful in reconstructing the range of technologic and subsistence practices developed

and used by earlier cultures, although certain vagaries in evidence must be recognized. Obvious factors that affect the retention of certain materials in a site deposit between occupation or use of an area and its later (archaeological) discovery include variable rates of decay or deterioration (i.e., floral versus lithic), potential for disturbance, disruption, or destruction of provenience, and curatorial behavior or transport (either by those responsible for the deposit or by later groups) of certain materials away from the primary site (cf. Schiffer 1976). Typically, artifact class as applied to prehistoric cultural deposits may include such elements as flaked stone, groundstone, rock features, pottery, basketry, fabric (matting, cordage, hides), bone, and waste (e.g., vegetal and chemical remains, coprolites, etc.). For the current study recorded evidence falls within a more narrow range, comprised of flaked stone, groundstone, and rock feature classes.

Conceptually, artifact type embodies the greatest detail in the reconstruction of past material cultures. As an element of classification, artifact type may provide an inventory of items left or discarded and retained in an archaeological deposit as evidence of some past human enterprise--subject to the same transformations detailed above for artifact class. Quite often, a type-by-type inventory can be used to infer or reconstruct those activities conducted during deposition of a given site, descriptions of industry (site function), subsistence (resource procurement), technology (manufacture or processing), and settlement (demography, lineages, and cultural relationships) being constructed in this fashion. One inherent difficulty with this classificatory scheme is whether artifact types recognized by the investigator are sufficiently similar to types recognized by those responsible for the cultural deposit. Ethnographic evidence, experimental study, background research, and scientific method are frequently used to ensure that some measure of confidence and reliability may be attributed to the artifact types defined for a particular avenue of research.

A variety of provisional artifact forms and features were examined during the current investigation (see Table 4). Definitions are based primarily on morphological considerations, although the more basic and macrosopically visible edge damage attributes were also observed on the various tool forms. The basic provisional types included the following: three varieties of flaking waste (debitage, technical flakes, and cores), four basic tool types (edge-damaged flakes, scrapers, bifaces, and hammerstones), and four feature categories (flake concentrations, core reduction stations, rock rings, and rock cairns). Descriptions of these classes and their variants are provided below.

<u>Flake</u>. This term refers to any specimen which morphologically appears to represent detachment from a lithic core through human manipulation. When used informally, "flake" is an all-

Table 4
OUTLINE OF ARTIFACT AND FEATURE CLASSES

I. FLAKED STONE

- A. Flaking Waste
  - 1. Debitage
  - 2. Technical Flake
    - a. Typological Blade
- B. Core
  - 1. Untyped or "amorphous"
  - 2. Unidirectional
  - 3. Multidirectional
  - 4. Platform
  - 5. Patterned
- C. Flaked Lithic Tools
  - 1. Edge-damaged flake
    - a. Unretouched--edge damaged only
    - b. Informally retouched
  - 2. Scraper
    - a. Formal
    - b. Informal
  - 3. Hammerstone
  - 4. Biface/Projectile Point

II. GROUNDSTONE

- A. Handstone
  - 1. Mano
  - 2. Pestle
- B. Platform (portable)
  - 1. Metate
    - a. Slick
    - b. Trough
    - c. Basin
  - 2. Mortar
- C. Platform (non-portable/ bedrock)
  - 1. Slick
  - 2. Basin
  - 3. Mortar

III. FEATURE

- A. Flake Concentration
- B. Core Reduction Station
- C. Hearth (circular)
- D. Hearth (pavement)
- E. Roasting Pit
- F. Rock Circle
- G. Cairn
- H. Stacked Rock Enclosure

inclusive term for two subclasses of flaking waste--technical flake and debitage. A technical flake is any flaked lithic non-tool that has one positive bulb of percussion and a striking platform but lacks evidence suggesting use as a tool. The term debitage includes those specimens which lack a bulb of percussion and/or striking platform, yet by virtue of discrete indicators, such as angularity, appear to have been generated through a human-induced flaking process. Technical flakes are generally easier to identify as having been generated by human agency than debitage. Technical flakes and debitage are the most common constituents observed in archaeological sites throughout the California deserts.

A third flake subcategory--typological blade--was also recognized in this study. Typological blades are a distinctive technical flake with a length at least twice the width and roughly parallel lateral margins. The arris ridgeline configurations often form one or two parallel lines running the full length of the dorsal face. This technical flake category is individually recognized because a specialized technology is often required to produce the artifact. Typological blades are usually obtained from prepared platform cores and are particularly useful tools either as-is or further refined into a variety of tool forms.

Core. A core is any lithic artifact with one or more negative flake scars and one or more positive striking platforms, but without evidence of use as a tool. Cores represent the nucleus from which technical flakes and debitage were detached and may be classed in a variety of ways. Four categories were selected for this study based on criteria of how the flakes were removed--unidirectional, multidirectional, platform, and patterned forms. A unidirectional core is one from which flake removal was in the same direction and orientation, including those artifacts termed "tabular" core by some researchers. In contrast, flakes were apparently removed in a variety of directions from a multidirectional core, producing a roughly spherical objective work piece. Some researchers have termed these artifacts "orbital" cores. A platform core is a refined type of unidirectional core ordinarily used to obtain typological blades. Such forms are prepared and show evidence of flake removal in a highly controlled fashion around the periphery of the striking platform. Some researchers have also termed such specimens "prismatic" cores. A bifacial flake removal approach is evident on a patterned core, producing a striking platform with a sinuous working edge contour. Each flake removal sets up a platform for subsequent flake removal in an opposing direction.

In this study, cores were placed into one of these four categories where possible. In reality, however, many cores are informal and do not manifest notably formal configurations. When

such specimens were encountered in a field setting, they were recorded as untyped or "amorphous" cores.

Edge-damaged Flake. This is an inclusive term denoting a variety of tool forms. The qualifying attributes are that the specimen have some variety of edge damage suggestive of use and that it not qualify for other, more formal tool categories. Edge damage may include, but is not limited to, edge rounding, nibbling, and micro-step flaking. Also included within this category are flakes with minimal or informal retouch not involving entire edges. Retouch on edge-damaged flakes was not performed in order to develop a particular tool shape, but to modify a portion of an edge to create a particular working edge angle.

Scraper (formal). This category includes all tool forms with at least one planate face and systematic unifacial retouch around the periphery to produce a roughly ovoid plan view. It is clearly apparent that the aboriginal craftsman was attempting to incorporate a particular shape into the tool, as well as develop a definite kind of working edge. The degree of retouch is beyond that necessary to create a single working edge. Scrapers have a variety of edge damage, such as edge rounding or micro-step flaking, which are suggestive of use.

Scraper (informal). This category is presented to designate those specimens that are less regular than formal scrapers, yet more formal in configuration than edge-damaged flakes. Specimens qualify for this category by having at least one formally produced, unifacially flaked working edge, edge damage suggestive of use, a roughly ovate or rectilinear plan view, and a definite planate face. This category distinguishes between formal specimens with retouch around 100 percent of the periphery and "classic" plan views and those specimens with a lesser amount of workmanship.

Hammerstone. This tool category includes all portable specimens, retouched or unretouched, that have edge or surface crushing as the dominant form of use damage. Stone-on-stone percussion usually creates these battered edges, which are quite distinctive and recognizable at the macroscopic level of identification. Hammerstones may be any shape, but are most often rounded cobbles or nodules that can be conveniently hand held. They may also be relatively small (perhaps as little as three centimeters in diameter) and used for refined percussion application.

Biface/Projectile Point. This category includes all bifacially flaked specimens that are roughly ovoid or triangular in plan view and lenticular to diamond-shaped in cross section. Five subclasses are recognized within this category based on the degree to which the specimen has been reduced, as discussed in Section V (Replicative Experiments). Biface production is a

linear process and the division between the reduction stages is relative. The first three stages include the less formal designs that other researchers have termed "blanks" or "preforms." A stage four or five biface is referred to as the implement stage and manifests stylistic attributes such as final shape, notching, channel flakes, and/or last row trimming. The important distinction is that the nature of these attributes may be temporally and culturally significant, and when possible during the investigation effort, bifaces were assigned to one of the five-stage reduction categories.

Groundstone. Two basic classes of groundstone tools (both portable) are recognized for the current study--manos and metates. A mano is a cobble-based, hand-held tool with evidence of use wear on at least one flat to convex working face. A metate is a portable to semi-portable milling platform with at least one flat to concave working face showing evidence of use wear.

Flake Concentration. An entire area within a given site boundary may contain a widely dispersed surface scatter of artifacts. Within these areas, discernible concentrations of flaked materials may be recognized as non-discrete, non-contiguous entities or separate loci. The smallest designated concentrations are those with an artifact density judged to be between twenty-five and fifty specimens per square meter, those of moderate size indicate a density between fifty and seventy-five specimens, and the largest indicates a density exceeding seventy-five specimens per square meter.

Core Reduction Station. This category includes relatively dense, very high concentrations of flaked lithic materials containing flakes and at least one core. These generally occur in a relatively confined area of less than two meters in diameter and may represent temporally discrete lithic reduction events. Two classes of core reduction stations were recognized--primary and secondary. A primary core reduction station is characterized by an assemblage in which 60 percent or more of the specimens retain cortex; a secondary core reduction station is an assemblage in which less than 60 percent of the specimens retain cortex surfaces.

Rock Ring. This class of feature includes all single-course rock configurations that are roughly circular or ovoid in outline. These features are usually approximately two meters in diameter.

Cairn. This category includes all concentrated rock features (as opposed to circular configurations) that exceed one course in height and may appear stacked or as deflated features. Cultural affiliation of such features has been documented as both

aboriginal and historic. Affiliation assessment is usually dependent upon associations with other site constituents.

This study has resulted in the identification, documentation, and recording of much cultural data from resource sites previously reported in the several LFMR study zones (Davis, Eckhardt and Hatley 1981; Hanna et al. 1981). Previous fieldwork in these zones resulted in a preliminary format for site occurrences, including isolated finds, informal quarries, multi-breakdown zones, secondary reduction areas, and multiple use sites (Davis, Eckhardt and Hatley 1981:67-127). As yet no soluble formula has been devised to categorize the kinds of sites encountered in the Assembly and Offense areas, and Cornerstone's research plan was developed to add a testable dimension to an interim or provisional site designation approach.

Previously described aspects (i.e., classification schemes) have been designed to provide greater clarity about the types of sites in the Assembly and Offense areas. Definitions, determiners, styles, and (if possible) functions for the varying sites have been refined in this study as outgrowths from the descriptive terms employed previously.

The inner workings of the varying site deposits (artifacts and features) allow a reconstructive element to be exercised that permits assessment of postulated activity events. Table 5 is presented to illustrate a generalized model for the level or intensity of activities relative to hypothetically constructed events.

Table 5
EXAMPLES OF THEORETICAL PROPOSITIONS AND THEIR RELATIONSHIPS TO THE CULTURAL RECORD

Propositions	Archaeological Occurrences	Hypothesized Events
Activity (basic unit)		
Individually situated Spatially distinct Element of activity set	Isolates Individual tool forms Primary flake reduction Secondary flake reduction Undesignated features	Extractive or maintenance process Rough-out tool forms Refine tool forms Floral/faunal exploitation
Activity Set		
Compound activities Superimposed or in close association Multiple activity elements Element of activity structure	Multiple occurrence Reduction stations with various formal patterns of cores, tools, or biface forms Limited variation within the range of activity residues	Extractive process Forming very specific tool forms Use of tools for specific or multiple tasks Use of variable base media and manufacturing techniques
Activity Structure		
Complex association of activities Noted associations distinguished by testing of hypotheses and subsistence models Reflection of social aggregate	Multiple occurrence superimposed or segregated Networks of activity sets (i.e., reduction station of formal tools used for various processes which produce subsequently measurable evidences)	Extractive or maintenance process Making and using formal tools Hunting and butchering various faunal resources Harvesting and processing various floral resources Forming and using wooden tools
Aggregate		
Reflection of prevailing sociocultural system Identified cultural and/or temporal affiliations	Tool forms reflecting culturally specialized and environmentally regulated tasks or behaviors (i.e., agave vs. pinon vs. small seed processing equipment) Complex intrasite stratification	Extractive and maintenance process Residual evidence which exemplifies specific ecological or climatological conditions (i.e., altithermal vs. anathermal vs. medithermal climates) and concomitant cultural adaptive (or maladaptive) responses

SECTION IV

PROGRAM METHODS AND DOCUMENTATION

The primary purpose of the present investigation was to locate, document, and describe cultural resources in the several study zones and to evaluate these against current criteria for inclusion in the National Register of Historic Places. These criteria are related to the resource's quality of significance in American history, architecture, archaeology, and culture.

> The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects of State and local importance that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and
>
> (a) That are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> (b) That are associated with the lives of persons significant in our past; or
>
> (c) That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
>
> (d) That have yielded, or may be likely to yield, information important in prehistory or history (36 CFR 60.4).

To this end, tasks entailed locating sites and obtaining information to aid in eligibility evaluation. Determinations of eligibility may have lasting effect on the preservation or disruption of cultural resources and cannot simply be made out of hand. Determination requires sufficient levels and classes of information to verify field reconnaissance information and to test assumptions associated with the sites under examination.

EXPLANATION OF FIELD STRATEGY

Field strategy for the current study was a complex blend of investigative techniques designed to refine the cultural inventory of resource sites in the several study areas and to clarify questions of particular resources' eligibility for nomination to the National Register of Historic Places. To that end, intensive pedestrian survey, instrument-controlled mapping network, mapping, documentation and recording, limited subsurface testing, and geomorphological reconnaissance and assessment techniques

were employed. The methods and documentation of these procedures are detailed below.

Intensive Pedestrian Survey

Cornerstone Research deployed teams of qualified field survey archaeologists prior to conducting the detailed mapping program. Personnel were screened for experience and academic achievement. Many had received extensive training with other professional archaeologists; however, procedures employed during this program required additional orientation. Written and verbal instructions of each task were provided to ensure continuity of information retrieval for the pedestrian survey aspect of this investigation.

Personnel were organized into five-person study teams, each led by a reliable team leader. Overall supervision of the crews was the responsibility of the co-principal investigators, who coordinated the entire survey effort with the team leaders. The co-principal investigators were also responsible for daily maintenance and collection of field records and personal field notes. Study assignments were coordinated by the principal investigators based on daily logistics considerations and U.S. Army mission-related events. The pedestrian survey began on April 9, 1981, and concluded on April 16, with one additional day on April 21. Crew size varied from three to twelve people, averaging six persons per day. Approximately 470 person-hours were expended during this survey.

The survey began at the northwest portion of the required study zone near Summit Graves Pass. The study teams conducted modified survey transects, incorporating linear, zig-zag, and intuitive coverage patterns to ensure complete coverage and a high cultural deposit location rate. Maximum average distance between team members was thirty meters, with closer study intervals when warranted at the discretion of the team leaders or principal investigators.

Directional travel was maintained by line-of-sight and compass bearings on regional landmarks and prominences. Major localized topographic features, road systems, and benchmarks were also used to maintain accurate team positioning. In areas of highly dissected terraces or alluvial fans, survey teams conducted systematic examinations conforming with these primary landform segments. Where cultural deposits were located in a highly dissected physiographic setting, the landform segments were individually inspected to aid in site/loci boundary descriptions and material constituent notations, thereby providing more comprehensive documentation of the cultural resources.

The first step upon location of a cultural deposit was to distinguish sites from isolates. Specific site types were then

assessed in relation to the material evidence or activity residue in the cultural deposit. Site types address intersite activity sets or behaviors, such as primary and secondary core reduction, tool refining, milling, cutting, scraping, chopping, or combinations of these and other observable site activities.

The study team closely examined the area surrounding cultural deposits and features to delimit the areal extent of the deposit's surface manifestation. Each site or isolate was recorded on archaeological site data forms provided by Cornerstone Research. A short form was completed for isolates and an official State of California Archaeological Site Survey Record form was used for more extensive cultural deposits. Data recorded on the site form included site location and dimensions, amounts and types of flaked lithic and other artifactual materials, any site disturbance, proximity of water sources, and brief environmental and physiographic information. Sites and isolates were marked with a data chip and all provenience information of inter- and intrasite activity loci were registered from this reference point. Thirty-meter tapes and survey instruments or Brunton compasses were used to determine intrasite distances and orientation. Reference bearings were taken using hand-held magnetic compasses relative to local prominences and established control points (see the discussion below) from the position of the data chip. These data were later plotted on topographic maps and intersite distances and orientation were recorded. Photographs were taken of diagnostic site materials and of overall site areas. The location of particular intrasite artifacts was plotted onto field sketch maps, when appropriate. Constituent site materials remained in the field, but isolated finds were recovered from the field for continuing analysis.

Site records, photo log sheets, all recovered isolates, and plant or soil specimens were collated, stabilized, and cataloged daily by the project team members under the direction of the co-principal investigators. A summary of findings and disposition of each documented cultural resource wsd logged in the field supervisor's daily record. All site data forms have been submitted to the San Bernardino County Museum, from which trinomial designations (sites) and SBCM designations (isolates) have been received.

<u>Instrument-controlled Mapping Network</u>

To accomplish the required detailed mapping aspect of the proposed project, Cornerstone Research retained the services of Alidade and Rod Topography Maps, Inc., to establish a ground control network throughout the proposed detailed mapping area. The control point network provided visible markers for use with triangulation techniques to determine precise locations of intrasite/locus data points. The control point series was established by a two-person crew from A.R.T. Maps and a field assistant from

Cornerstone Research during three field visits (April 10-14, April 22-25, and May 13-15, 1981), for a total of 314 person-hours.

Initially, a series of primary control points was positioned at optimum locations over the entire study area. These positions were placed approximately 500 meters apart and consisted of combinations of semipermanent monuments, brass pins implanted in boulders, and heavy-gauge steel reinforcement bars, each accompanied by lesser-gauge reinforcement bar to support lengths of brightly painted and flagged PVC piping. Target configurations were also employed as visibility became a problem.

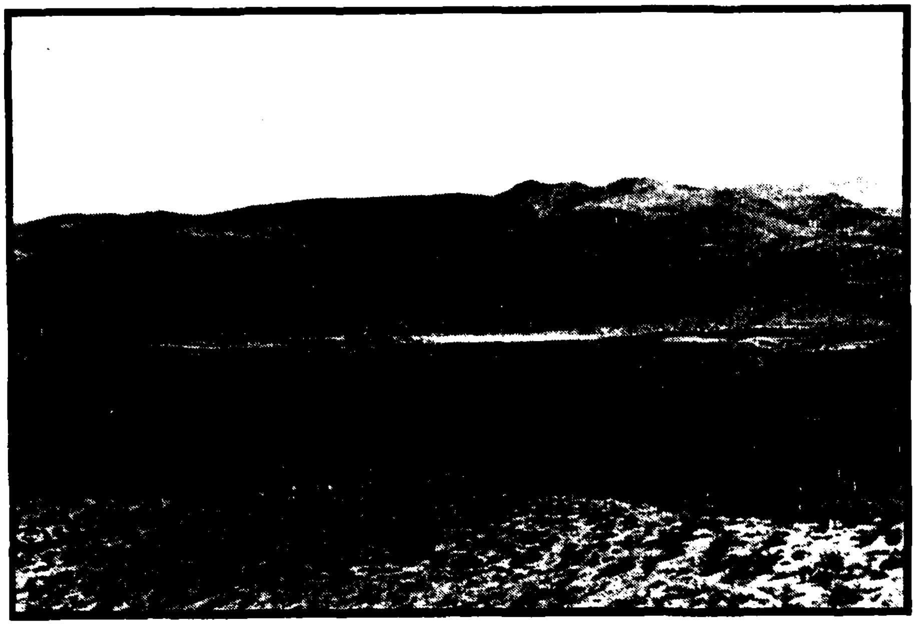
From these primary positions designated by letters, an additional subdatum series was established. These secondary positions were more numerous with less distance between points and each had distinctive numeric designations. Incised data chips were installed at these positions for long-duration referencing.

A.R.T. Maps generated reproducible plat maps showing the accurate position of each primary and secondary network reference point. Blue line prints of these 1 cm = 20 m plan view maps were issued to the team leaders for detailed mapping and documentation.

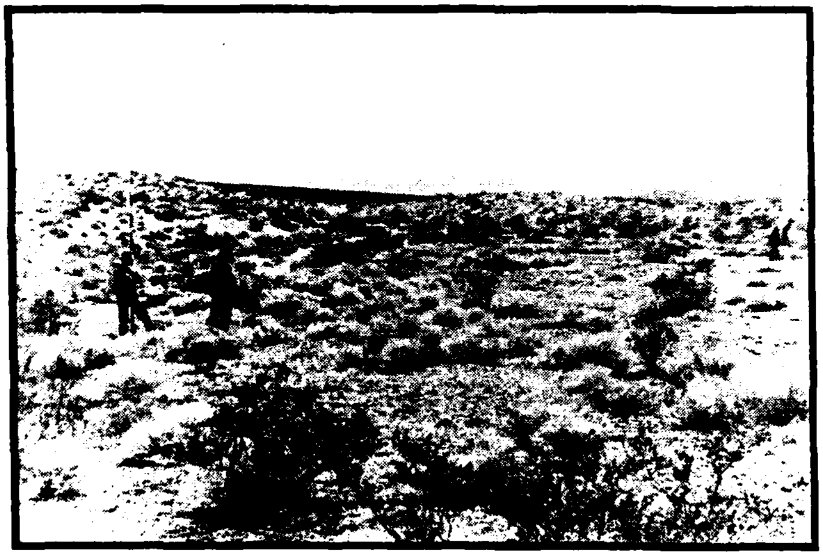
<u>Mapping, Documentation, and Recording</u>

This aspect of the project required detailed information recovery and mapping of previously recorded activity loci with complex internal activity structures (Photograph 1). These areas were relocated, assessed as to kind of features or elements present, and plotted on the plat sheets provided by A.R.T. Maps (see details below). For each activity locus, a central datum point--tied into the control network--was established by the team leader. Team members then documented specific observations for each activity set/feature. Mapping and documentation occurred during two primary field efforts--April 14-May 21, 1981, and May 5-May 15, 1981. Total hours expended during this aspect of the project were approximately 2,417 person-hours.

Detailed observations included overall dimensions of the features, total counts of all associated feature elements, ratios of features present, physiographic situation, and a general overview of the lithic artifact characteristics. Particular attention was paid to the degree of embedment, presence/absence and amount of mineral oxidation, patterning of flake removals (i.e., systematic versus random), flake terminations, evidence of use, and variations in lithology. This process of information retrieval assisted in tabulation of the subregional occurrence and interrelationships of these cultural deposits.



Photograph 1. This overview is north toward the mouth of Bow Willow Wash, a portion of the intensely documented area discussed in text. The lacustrine beds and outflow area for No Name Lake are visible in the center of the photo. In the foreground are higher terraces of older Plio-Pleistocene formations. Between these areas are lower, more recent alluvial fans grading toward Bow Willow Wash.



Photograph 2. Crew members in this photograph are surveying, flagging, and documenting cultural artifacts. In the center background is a plane table operator recording bearings and distances of artifact locations from team members in the foreground (left) using a stadia rod. This method worked well for establishing areal distributions of activity centers. See plat maps for results of this documentation method.

Photograph 3. This view shows team members preparing a plane table map for a portion of SBr-4204. Dan Whitney is operating an engineer's transit, while M. Jay Hatley and Joe Vogel are discussing the most effective techniques to record the data. Data is being gathered from additional field crew members (not visible) who have surveyed and flagged artifact concentrations within the study area.

Documentation, recording, and mapping of the various areas was done in a series of steps. A three- to six-person team first surveyed the area, locating diagnostic or significant activity areas and/or artifacts (Photograph 2). Crew members then reviewed the findings to document and photograph these activity phenomena. Documentation was either a very brief description to indicate general areas of various cultural resources for the subsequent mapping or a more thorough description for future determination about activity focus. The latter description also involved maps of core reduction areas and sketch drawings or measurements of potentially diagnostic artifacts.

As this recording was in progress, one team member compiled a general overview of the segmented research zones, indicating areas of high or low density of flaked lithic specimens, general types of artifacts and artifact concentrations observed, and predominant physiographic and environmental features. This overview, in conjunction with the more specific and detailed descriptions, was used to establish an overall description of the mapped zone's cultural resources and activities.

Mapping was done from a series of plane table or transit stations triangulated to the previously established A.R.T. control points (Photograph 3). Shots from the mapping station were assigned a number corresponding with the recorder's notes; these numbers were then coded onto the map depicting provisional artifact types, artifact concentrations, and major physiographic features, such as prominent drainages, washes, hills, and terraces. Because of time limitations and the Army's continuing training mission, detailed analysis and description of individual artifacts or concentrations could not be provided. In this sense, the resulting plat maps are the most detailed record of the total documentation program.

Due to the known complexity of cultural deposits near the head of the Bow Willow Wash zone, the detailed mapping program commenced the north end of Bow Willow Wash. After the first day's effort, it became apparent that the IAS guidelines for designating site versus isolate (see Appendix B) would be unworkable for boundary delineation. At the direction of the co-principal investigators and with concurrence from the IAS Contracting Officer's Representative, the information recovery methods assumed a distinctly different approach. The problem of the very time-consuming boundary differentiation was alleviated by assuming a centric format; that is, the team members were directed to locate the centers of cultural activities and then work out from these high-density deposits to the less intense margins. In a few cases, documentation procedures were abandoned where artifact and feature counts diminished abruptly or too great a distance from control points was realized. In this fashion, the key data base features and residues were more economically examined. The central points of the activity centers were

established by optical survey instruments, then coded and positioned on the plat maps.

Upon returning to the laboratory after the field aspect, the arduous task of preparing reproducible-quality plat maps was undertaken. Advanced graphic techniques using various data mediums, including DMATC metric scale maps, plane table data relating to drainage patterns and other physiographic features, and aerial photographs, were employed. A variety of techniques was necessary because in several cases field time allotments, as directed by the chief of the Interagency Archeological Services Division-San Francisco, allowed only limited recovery of physiographic data by plane table and alidade techniques.

Patterned artifact characteristics were used as the basis for compiling, evaluating, and codifying the written and photographic record. Knowledge of morphological and functional indices permitted the arrangement of artifact characteristics into "trial groups." This provided a framework within which to examine cultural and chronological associations and resource variability.

Limited Subsurface Testing

Limited subsurface testing was conducted at locations within site SAD-1, selected after analyzing intrasite mapping data. Factors such as potential subsurface cultural material deposits, locations of probable areas for buried paleo-sol deposits, and questions relating to key associations between human behavior and archaeological patterning also guided selection. A single test excavation unit measuring one meter by fifty centimeters was chosen for controlled subsurface examination, and two additional twenty-five-centimeter-square volumes of soil were excavated and screened in an effort to further define site limitations.

Excavation of test unit one and the two subsequent tests by a two-person crew (supervised by a co-principal investigator) commenced on June 12, 1981, and was completed on June 14, 1981. Approximately forty-three person-hours were expended on this subsurface investigation.

The unit was excavated with standard excavation tools in arbitrary ten-centimeter increments to a depth of fifty centimeters, conforming to the surface contours. Soils were screened through one-eighth-inch mesh and data from each level were recorded on excavation forms. Prior to backfilling the test excavation unit, a column sample of soil was removed in five-centimeter increments and packaged for future study. Sidewall profiles of each wall were sketched and photographs taken. After backfilling, the area was returned to its natural contours.

Geomorphological Reconnaissance and Assessment

As part of the analysis of data from resource sites in the Assembly and Defense zones, geomorphological examination was conducted to assess the antiquity, integrity, and condition of physiographic features and cultural resources in the Bow Willow Wash and Silver Lake Road regions. Survey-level information indicated that many of the cultural activity residues were subjected to in-place weathering and incorporation within desert pavement formations and that useful information was likely to derive from geomorphological assessment. This aspect was conducted by Dr. Roy Shlemon and one co-principal investigator between April 27 and April 28, 1981. A total of roughly forty-four person-hours was spent during this reconnaissance and assessment. Additional analysis by Dr. Shlemon and the co-principal investigator on February 28, 1982, required eight person-hours.

One focus of the geomorphological examination was the degree of embedment of artifacts in desert pavement formations. Of the many agents that affect these surfaces and bring about the pavement formation processes, wind removal of finer particulate matter is considered a major influence. Analysis of embedment of artifacts in desert pavements may be a guide to interpreting their relative antiquity.

Another important aspect of this research was the potential for discovery of the co-occurrence of ancient soil horizons and evidence of early human occupation. True soils, or "solum," form only during a steady state--that is, in-place development without erosion (cut) or deposition (fill). These paleosol strata would tend to retain evidence of any past cultural occupation versus the evidence being obliterated by physical processes.

Other geomorphological questions relate to the hydrologic properties of Bow Willow Wash. Extensive cultural activity residues were reported along this relict streambed channel, and the relationship between the resources and this ancient watercourse was another focus of the current inquiry. In addition, arroyo formation throughout the study areas attests to the vicissitudes of time that contribute to the eradication of older alluvial fans and other stable surfaces. This process was studied to determine the potential for disruption or disturbance of original cultural activity localities.

Geomorphological reconnaissance and assessment commenced with close examination of aerial photographs to gain an understanding of the physiographic setting regarding present erosion patterns and interruptions in these patterns through faulting as evidenced by lineaments, offsets, and isolation of relict watercourse channels. The latter are manifest by differential aging of the petrological units and show differing textures or tone on

the aerial photographs. The more stable geological settings aid in preserving the cultural deposits from natural degradation by erosional forces. On the basis of this aerial photographic review, particular zones of interest were selected for on-foot inspection and review. Manually excavated straticuts and exposed profile analyses were employed to reveal preliminary information about subsurface conditions and contents. Limited trenching and more formal stratigraphic analysis techniques were originally proposed but disallowed by National Park Service representatives.

Geomorphologic data gathered in this fashion were used to develop operational or working hypotheses about the formation and development of existing physiographic conditions within the several study zones. This process supported the total cultural research program by providing reasonable interpretations of the antiquity and past environmental conditions surrounding cultural activity residues in the Bow Willow/Assembly Area and Silver Lake Road regions.

EXPLANATION OF LABORATORY METHODS AND ANALYSIS

Cataloging and Curation

Cataloging and curation procedures employed in the present study follow those currently used by local universities and other institutions. All artifacts obtained by surface collection or subsurface excavation were washed, dried, preliminarily analyzed, weighed, measured, and categorized within a provisional typological system (presented in Section III). These data, along with other relevant information, were entered on standardized catalog cards to facilitate further inspection and evaluation.

Each individual artifact accurately received a consecutive catalog number (inked directly on the artifact or written on an attached tag or label if the specimen is small). Data from the catalog cards were entered on master catalog sheets in sequential order and placed in binders for safekeeping. All cataloged artifacts, divided by typological categories, provenience of discovery, and site designation, were placed in labeled boxes for storage and temporary curation at Cornerstone Research's laboratory in San Diego.

Research into the lithic technology of archaeological materials such as those recovered during this project was conducted by Cornerstone Research. This research generated a preliminary set of terminologies and forms to aid in describing lithic artifacts (see Appendix B). Specific characteristics observed include the following: striking platform and fabricator contact area size and condition, type of evident platform preparation and distal termination, direction of the mass form, percentage of cortex, polar reference and termination codes for previous flake

removals on the dorsal face, type of dissection, and presence or absence of compression rings, fissures, bulb of applied force, eraillure and meniscus lens (flake), natural cracks, and patina-tion or oxidation (see Crabtree 1972 for discussion of these terms). Although still in a preliminary stage, these observa-tions are designed to provide data relating to the lithic tech-nology used to produce the artifact and the possible function or use of various artifact forms.

Disposition of Material Collection

The cultural materials recovered from the field during the current investigation are temporarily curated and housed at the Cornerstone Research laboratory for cataloging and preliminary analysis. Permanent curation will be the responsibility of the U.S. Department of the Army once the final document has been completed.

Replicative Experiments

The Bow Willow Wash/Assembly Area cultural resource complex is located in a region where soil deflation and desert pavement formation prevail. Under these conditions, culturally related soils (middens) are dispersed and/or radically consolidated, and the organic cultural residues (e.g., wood or bone artifacts) that may once have been preserved through burial are gradually exposed to harsh climatic conditions and break down and dissolve. In these regions, flaked lithic components of the archaeological record constitute the majority of the residual cultural materi-als. Exceptions to this rule generally occur in caves and rock shelters where midden soils have been protected from erosion and are capable of preserving the more soluble organic remains of cultural activity.

Buried site components have rarely been located during recent reconnaissance operations, although current geomorphologi-cal investigations may offer insight into primary areas for po-tential yields of buried cultural resources. Thus, the materials left for analysis are stone tools, residues of tool manufacture and use, spatial interrelationships of these stone artifacts, and the landforms upon which they are located. However, even with these limited observable cultural materials, the nature of the flaked lithic residues of the project area is such that a wealth of information can be derived relating directly to reduction and functional strategies. Although suffering from various levels of previous military impact, the cultural resources remain in a state of preservation seldom found in unprotected regions of the Mojave Desert where pothunters and rock collectors exact a heavy toll by removing certain artifacts or otherwise destroying the completeness and integrity of the resource data base.

The cultural resources surrounding the Bow Willow Wash/Assembly areas may be roughly grouped into two types: quarry workshops and multiple purpose sites. The term "roughly" is to be emphasized since core reduction stations occasionally occur on multiple use sites, while finished tools are sometimes found in quarry sites or as isolated finds. It is important to note the close geographic proximity of quarry sites to multiple purpose sites. The latter are generally located near extinct water channels and the activity residues associated with them are primarily indicative of non-lithic resource exploitation activities. In addition, the prehistoric Bow Willow Wash environment--one that supported the culture, or cultures, responsible for the remnant deposits at the multiple use sites--could have been exceedingly attractive, with both fluvial resources and lithic resources available in the immediate area.

Relationships between the quarry workshops and the multiple use areas, the function or functions of the multiple purpose areas, and the full nature of the quarry workshops have yet to be determined; however, the cultural resource data base from which this knowledge could be derived is definitely present. The relatively pristine lithic concentrations and deposits, along with the variety of landforms and geological deposits, possess a high degree of research potential for archaeological and geomorphological research.

Survey level inquiry indicated that the resource base under consideration reflects raw lithic quarrying as a primary area activity, with various internal loci suggesting additional work piece refinement, as well as zones of multiple activity evidence. This prior knowledge focused selection of a trial group of provisional artifact and site types for the current project with emphasis toward core reduction technologies and biface production morphologies. As an outgrowth of these interests, Cornerstone Research conducted replicative studies of both platform and multidirectional cores and biface forms. These artifact forms were selected for replication due to their high frequency of occurrence within the study area. The experiments were performed by Mr. Rod Reiner, Ms. Lisa Roe, and the Cornerstone Research staff. The replication approach was directed toward establishing definitions of element terms and identification of fabrication stage sequences and the key indicators or criteria for these artificially constructed reduction sequences.

To provide an understanding of the complex nature of research problems associated with lithic resource procurement and tool fabrication technologies, an overview of critical factors has been formulated. The following discussion focuses on raw lithic selection, procedures and techniques of tool fabrication, and a partial list of significant variables associated with lithic technology and artifact replication as presented by Moffat

(1981). In addition, a brief discussion of the problems and solutions affecting the replicative studies is presented.

A prerequisite of formal tool manufacture is the selection of a suitable raw lithic material. From an archaeological perspective, serviceable materials are generally found in two physiographic settings: outcrop locations and materials naturally eroded from the parent outcrop and deposited down-slope in various forms, such as nodules, cobbles, and pebbles.

Outcrop sources can occur in a variety of forms--flows, stratified units, and veins. Flows may consist of glassy material (e.g., obsidian), vesicular materials lined or filled with other minerals (chalcedony), or dikes or sills of either glassy or vesicular materials. Stratified units of lithic materials may appear as massive or thinly embedded material sources or as conglomerates of pebbles, cobbles, and boulders. Veins consist of fractures in the rock unit that have been filled with siliceous minerals, such as chalcedony or quartz.

Lithic source materials located away from an outcrop will usually appear as "float." Such materials, naturally transported from an outcrop source like those described above, are present in an archaeological setting as nodules of obsidian, chalcedony, or other lithic materials. Generally, as these float materials are transported further from the parent outcrop, they become smaller and more rounded.

Since the style and function of the finished tool depends heavily on the grade of the stone (as well as the competence of the tool maker), material selection is the first step in tool production. As detailed by Reiner during the current study, five primary factors must be evaluated when selecting a suitable lithic material. The lithic material should have no cracks within the body of the stone; such defects will deflect the energy of applied force, thereby causing uncontrolled obtuse breakage and limiting the ultimate size and shape of the work piece. The amount of glass-like material within the stone controls fracturability. Numerous studies have been conducted to determine whether heat treatment improves the quality of marginal lithic material (Flenniken and Garrison 1975; Sollberger and Hester 1972; Reiner 1981:personal communication; and others).

The fine- or coarse-grained characteristic of the rock is also important--the more grainy the rock's texture, the more difficult the material will be to work. Coarse-grained lithic material requires heat treating to create a usable material. Moffat (1981) provides a detailed explanation of the physical properties of both heat treated and non-heat treated lithic material subjected to static and dynamic loading. The percentage of flawless surface area, or area without surface cracks, is a fourth factor which influences the finished product. Surface cracks tend to

concentrate high levels of stress (flaws termed "stress raisers") that can interfere with controlled flake removals (Moffat 1981:200). The final factor is whether the rock contains internal intrusions or features such as air pockets, chalk, or crystalline impurities.

When the available lithic materials are not optimum for tool production, a heat treatment process may be used to upgrade the raw material. It is evident in the archaeological record that many stone materials were positively altered by heating. This annealing process gives the stone more elasticity, making it easier to work:

> The alteration makes the stone more vitreous and the worker can make tools with more precision and with much sharper edges. Each material responds differently to heating and one must become familiar with the stone being altered to determine the temperature and allotted time of heating and cooling (Crabtree 1972:5-6).

Additionally, Reiner has noted that materials requiring heat treating respond more successfully if first broken into small, manageable pieces. These work pieces may be macro-flakes or stages 1-3 biface forms. This strategy is supported by ethnographic references as presented by Thomas (n.d.).

Through his experience in working with various sources of lithic materials from quarry sites, Reiner developed four factors useful in determining activity patterns at a site. As listed below, these factors are prerequisites to answering questions such as, how extensively was the quarry exploited? and, was the quarry originally composed of a rich or poor raw lithic material resource? The four observations are:

1. How much unused lithic material is present in ratio to artifacts?

2. What is the ratio of cortex to no cortex on the artifacts?

3. What is the frequency of thin, straight percussion flakes without cortex and what are the sizes of these flakes?

4. Are percussion flakes with a high amount of curvature and cortex the predominant flake type observed?

Several inferences regarding activity patterns at quarry sites can be generated when questions like those above are answered. For example, a large amount of flake residue at a quarry site may indicate that the rock source was of primary or secondary importance. If flakes with cortex predominate, it can

be assumed that little or no material could be spared and that a majority of the workable material was removed. Quarries containing large amounts of high-grade, glassy flakes most often indicate an abundance of available material, and one can frequently expect to find the particular rock source spread over a vast area. The Bow Willow Wash area at Fort Irwin, for example, contains large quantities of high-grade, workable lithic material, and these same materials appear over much of the surrounding region. In contrast, smaller, localized quarries suggest that the distribution of the raw material was less prevalent. In the Mojave Desert it is important to note that small pieces of high-quality flaked lithic material found sporadically over an area will not necessarily indicate a nearby high-grade quarry as, generally, these remnants will have been brought into the area from an unknown remote source.

A typical quarry site from an archaeological standpoint can be summarized as follows. The predominant material will be large percussion flakes with visible curvature and high rates of cortex, the already reduced specimens having been removed (curated) from the site to other unknown locations. The cortex will have been flaked off before leaving the quarry, and the knapper will have sorted the potentially usable flakes (macro-flakes, straight thin flakes, etc.) from nonusable material (blocky end pieces, curved thick flakes) to avoid carrying unnecessary weight (Crabtree 1972).

According to Reiner, the predominant specimens removed from a quarry site, or curated by aboriginal populations, would be:

1. Core preforms
2. Plates
3. Flakes from prepared cores
4. Incidental flakes from core preforms
5. Small, rounded, and bidirectional cores

Reiner further suggests that the preferred removal order will be as outlined above if the tool maker desires a maximum quantity and size of finished tool. Additional lithic resource conservation can be achieved through curation of the maximum-size by-product materials (i.e., plates, straight flakes, etc.) to be subsequently formed into various flake-based tools.

Reiner has also formulated a list of items that will generally not be removed from a quarry site (residual waste), materials considered poor for tool production:

1. Highly curved flakes
2. Shatter or splinters
3. Flakes with triangular cross sections (with or without cortex)
4. Lithic pieces having cracks, inclusions, or pockets

5. Globular stones or corners off rounded boulders
6. Masses caused by multiple hinge or step terminations
7. Flakes too small to be of further use (with or without cortex).

The earliest stages of biface tool or core production--blank and preform manufacturing--are most often conducted at or near the quarry in order to avoid carrying heavy, useless stones from the quarry to encampments. Crabtree defines these initial-stage artifact forms as follows:

> Blank: A usable piece of lithic material of adequate size and form for making a lithic artifact - such as unmodified flakes of a size larger than the proposed artifact, bearing little or no waste material, and suitable for assorted lithic artifact styles. The shape or form of the final product is not disclosed in the blank. A series of objects in the early stages in the manufacturing process before the preform is reached (Crabtree 1972:42).

> Preform: Preforming denotes the first shaping. Preform is an unfinished, unused form of the proposed artifact. It is larger than, and without the refinement of, the completed tool. It is thick, with deep bulbar scars, has irregular edges, and no means of hafting. Generally made by direct percussion. Not to be confused with a "blank" (Crabtree 1972:85).

The finished product, a biface, is defined as an artifact with flake scars on both faces (Crabtree 1972:38).

Stone knapping experiments, such as those conducted for this project, have uncovered several strategies of the in-field quarrying process. The knapper generally selects raw specimens suitable for platform cores and large, thick flakes. The knapper also seeks lithic materials with acute angles; if these are non-existent within the available materials, the knapper creates or "sets up" such angles through stone knapping procedures and techniques. Both hard and soft hammers are used, depending on the lithic material, and the knapper constantly attempts to maintain a six-to-one ratio of thickness to width of the objective piece during the initial bifacial tool reduction sequences.

The most common flaking technique during the early stages of bifacial production is percussion:

> Percussion flaking is a method of striking with a percussor to detach flakes or blades from a core or mass. Percussion flaking includes varied techniques to remove flakes by either impact, collision or concussion (Crabtree 1972:80-82).

Available materials for both the resulting work piece and the percussor determine the specific fabrication technique. Crabtree (1972:9) discusses the relationship of percussor to lithic material as follows: "The hardness or softness of the hammerstone controls the interval of contact between the percussor and the flint-like material, for the time of contact is proportionate to the yield and density of the percussor." Contact time is longer if the hammerstone, or percussor, is a softer material (e.g., sandstone, wood, antler, or bone). Contact time is shortened if the percussor is a hard wood or stone. Correspondingly, the percussor must be a size and weight to achieve the desired results; a soft percussor, generally, should be larger and heavier, with a higher velocity striking blow required. Crabtree further states that extremely hard percussors are rarely used because they often shatter the work piece, whereas softer hammers contact a larger area, resulting in flakes with diffused percussion bulbs.

Examining the percussor's wear patterns also aids in interpreting the tool making techniques:

> The position and depth of the wear pattern, striations, bruising and battering aid in reconstructing the manner in which the percussor was held, the way the blow was delivered and the probable stage of manufacture (Crabtree 1972:9).

The second major technique used during bifacial tool production is pressure flaking. Sharer and Ashmore (1979) refer to pressure flaking as a more refined method of extracting flakes from a core. Crabtree discusses pressure flaking as follows:

> Process of forming and sharpening stone by removing surplus material - in the form of flakes - from the artifact by a pressing force rather than by percussion (1972:85).

The above-mentioned forces have been further defined by Speth (1972) to emphasize that static loading (pressure flaking) and dynamic loading (percussion flaking) will assume very different physical responses, producing differing evidence in the archaeological record.

The general purposes of pressure flaking are: 1) removing long, thin, flat flakes or blades, 2) removing irregularities on the work piece, and 3) straightening, sharpening, and modification of the tool. Tools used for pressure flaking include deer and elk antler, rodent bones, hard woods, and shell; stone pressure flaking tools are very rare.

Pressure flaking is a more controlled tool making technique to be used when a homogeneous or sharp cutting edge is desired.

Generally, the various pressure flaking techniques "involve placing the pressure tool on a prepared or natural platform on the margin of the preform and applying pressure force to detach a flake on the obscure side" (Crabtree 1972:14). Many variables affect the pressure technique used, such as morphology and function of the desired tool, the knapper's techniques and abilities, qualities of fracture and grade of the work piece, available platforms and lithic materials, and available pressure flaking tools (Crabtree 1972:14).

Pressure flakes usually are more rounded and less abrupt in appearance than percussion flakes. Cortex and acute curvature of the flaking debris are also less characteristic of pressure flaking. Differentiation between pressure and percussion flaking, soft- and hard-hammer fabrication methods, and other potentially meaningful (diagnostic) core reduction and tool manufacturing strategies do not assume a simple one-to-one relationship. Most contemporary researchers realize that delineation of technological indices is established by rigorous testing and evaluation of large amounts of materials, culminating in statistically significant frequencies of key variables.

The following information from Moffat (1981:207-209) is presented to illustrate the complexity of factors and variables that could affect the resulting evidence observed in an archaeological context or in a replicative study:

A Partial List of Significant Variables

I. Properties of the material being fractured
  1) Elasticity and plasticity
  2) Hardness
  3) Homogeneity
  4) Brittleness and ductility
  5) Isotropy and anisotropy
  6) Condition of the surface
  7) Relative strength when subjected to stresses (i.e., tensile vs. compressive)
  8) Internal flaws
  9) Size of the object stressed
  10) Form or shape of the object stressed

II. Attributes of the device used to apply stress
  11) Shape of the stressing device
  12) Size of the portion of the stressing device in contact with the stressed material
  13) Hardness of the stressing object relative to the hardness of the stressed material

III. Variables relating to the experimental situation
  14) Type of loading--static or dynamic
  15) Amount of force applied to produce fracture
  16) Support given to the material being stressed
  17) Angle at which the force is applied in relation to

the surface of the object
18) Friction of the indenting object on the specimen
19) Point at which stress is applied relative to the edge of the specimen

The replicative experiments reported on in this study were conducted in two series for differing purposes. The first series was done in the classroom facility at John Miller Range on Fort Irwin for the benefit of the research team members. During these sessions, lithic technologist Reiner lectured on the general principles and techniques of stone tool manufacture. Discussions centered on raw lithic resource selection, use of various fabricators (hard and soft hammers, antler billets, etc.), and the many problems and solutions encountered by stone knappers. Techniques demonstrated by Reiner included edge preparation to allow more controlled flake removal; angle and direction of attack; velocity of the blow; and various strategies required to overcome obstacles such as flaws in the objective piece and mistakes (i.e., hinges and mass development) caused by miscalculated or unsuccessful flake removals. This general indoctrination was intended to demonstrate the many factors involved in core reduction and tool fabrication, thereby clarifying key indicators and better preparing the team members for observations of cultural materials in an archaeological context. All flaked lithic specimens resulting from these generalized replication series were returned to the Cornerstone Research laboratory and currently are undergoing detailed analysis.

The second experimental series was performed at the Cornerstone Research facilities in San Diego and focused on methods, residues, and products resulting from knapping of generalized biface and core forms. Much data has been published on flaked lithic experiments, ranging from replication of recognized artifact "types" (Crabtree 1966; Crabtree and Gould 1970; Flenniken 1978; Flenniken and Stanfill 1980; Sollberger and Hester 1973) to general flaked lithic experimentation conducted to gain insight into the effects of stone knapping using a wide range of lithic resources and various fabricators, methods, and techniques (Crabtree 1967; Bordes and Crabtree 1969; Newcomer and Sieveking 1980). Johnson (1978) compiled hundreds of references tracing the history of flint knapping experimentation.

The current studies were not designed to replicate any particular "type" of artifact, but rather to obtain assemblages of residual flaked lithic material from generalized biface and core forms. The intent was to aid in distinguishing various levels of core/biface reduction sequences based on residual waste flakage, as opposed to objective pieces or implement specimens that, in many cases, are curated and removed from the site of fabrication (quarry) by the aboriginal craftsman, leaving only the rejected pieces for interpretation. Further, it was anticipated that patternings of flake removal scars on the dorsal surfaces of the

waste flakes could aid in identifying various stages and possibly the intent of the deposit creators.

The actual core and biface reduction aspect was performed by Rod Reiner, assisted by Lisa Roe and the Cornerstone Research staff. Photographs were taken and a tape recording was made of the general discussion occurring during the work session. The knapping experiments were conducted out-of-doors to reduce the hazard of silicosis (pneumokonioses), a disabling affliction that attacks the lung tissue with symptoms similar to tuberculosis.

Ten reduction experiments were conducted. Three generated residues from core configurations. The remaining seven focused on various reduction sequences of biface tool morphologies. Raw lithic material was provided by Reiner and included two kinds of obsidian--one variety from Oregon and another high-grade black obsidian from Northern California. In addition, one biface tool experiment was conducted on "white knife chalcedony" obtained from the Battle Mountain region in Nevada, and another biface tool form was fabricated from a "Bow Willow Wash" chalcedony nodule removed from the northern portion of Fort Irwin.

All reduction experiments were performed with a variety of fabricators, including hard-hammer percussors (round and elongated quartzite cobbles), soft-hammer percussors (tabular sandstone and shale), and elk and deer antler billets. Antler tines fastened to forearm-length wooden staves were also used as pressure flaking tools. In addition, various course-grained stone abraders were used to sand, grind, and straighten the lateral margins of the objective pieces (edge turning) as needed to facilitate better-controlled flake removals during most of the reduction stages. Protective glasses, leather pads, work gloves, and wood blocks (to control end shock) were also used during the experiments.

The tool kit mentioned above was alternately used in a "whatever-it-takes" manner to obtain successful reduction results. This more natural procedure--also considered probable in prehistoric tool manufacturing industries--is regularly used by Reiner and other contemporary stone knappers.

As each experiment was conducted, all resulting waste lithic material and the objective pieces were retained (Photographs 4 and 5). Due to the complexity of the recovery problem and the speed of material reduction of some tool forms, it was very difficult to control reduction stage segregation and still maintain momentum of the knapper. Therefore, a minimum 10-percent contamination factor has been estimated between the stage residues and the differing experiment material residues.

Specimens from each experiment were collected, labeled, and packaged for further examination under laboratory conditions.

Photograph 4: Shown in this photograph are examples of flaked lithic residue collected during replicative experiments at Cornerstone Research. The small flakes below the biface (at center) represent stage 4 and 5 pressure flaking. The implement-stage biface is 7 cm in length.

Photograph 5. This photograph shows various biface forms prepared during the replicative experiments. The replicas approximate artifact forms observed at sites during documented investigations. For size comparison, the obsidian biface at lower left is 12 cm in length. These specimens and the residual flaked materials are undergoing detailed analysis at Cornerstone Research.

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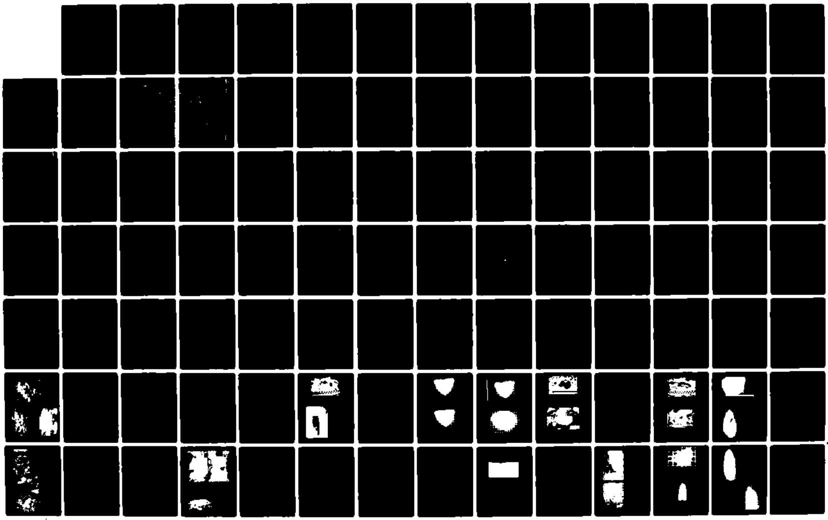

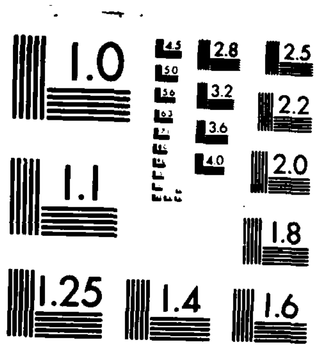

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During the latter process, the materials from each of the experiments were sorted and evaluated. Since edge damage (in terms of utilization factors) was not an issue, the reduction debris was size-sorted through hardware cloth of one-quarter-, one-eighth-, and one-sixteenth-inch mesh. Materials that filtered through the one-sixteenth-inch mesh were also retained, more for curiosity than for analytical diagnosis.

The larger flake specimens were examined for their potential to provide subsequent work piece media (i.e., suitable for production of additional flake-based tool items). They were also closely scrutinized on the platform aspects to determine if evidence of previous edge preparations survived the impacts of detachment. This is an important consideration as the same effect may be visible on platform areas as last-use evidence from worn contact surfaces of tools that required rejuvenation flake removals to sharpen still-serviceable tool forms.

The replicative experiments revealed various forms of information useful to the current study, as well as a number of ancillary findings. Since each experiment stopped at differing stages of reduction, the resulting residual flake material is not necessarily quantifiable between assemblages. Therefore, no summary of frequencies will be presented. It is sufficient to note that large amounts of reduction waste were created very quickly and that indelible evidences of reduction patterns are retained on the flake specimens. It was also noted that vast amounts of very small lithic fragments were propagated (especially from stages 2 and 3); however, given the effects of wind and water erosion and the abrasive action of sand and gravel within the project area, the attrition rate for these materials would be very high and probably would not be detectable or recoverable considering the amount of time lapse.

While generally reviewing the waste material, several unintentionally produced "typological blades" were observed. Reiner proffered the fanciful idea that perhaps aboriginal technologists acquired the idea for this specialized flake form through such an accidental natural selection discovery.

The core replicative experiments showed that more serviceable plates were retained from platform and multidirectional cores than from biface reduction. A higher frequency of edge abrasion retention was observed on flakes from biface tool fabrication than on the core production waste. These preliminary findings permitted formation of various testable reduction sequence models through which further refinements in a technological approach to resource analysis and interpretation can be instituted.

The criteria for biface reduction stages simply reflect attrition rates of cortex, the generation of multiple-course flake

removal scar patterns, and change in cross section configuration (Figure 3). Generally, stage one bifaces show deep, wide decortical flake removals that originate from natural lateral edge surfaces. These early-stage flake removals are usually accomplished by use of hard hammerstones. One explanation for this action is to reduce the amount of attrition of the more highly valued (i.e., difficult to obtain and replace) antler batons and billets. These fabricating devices are more often used in latter reduction stage sequences. The specimens from stage 1 reduction retain roughly 20 percent cortex. The waste flakage exhibits a high rate of thick, curved primary, or cortex-backed, flakes, with cortex on the flake platform surfaces in significant percentages. The biface cross section is irregular or blocky.

Stage two reduction will show second and third rows of flake removals, loss of natural edge platform angles, a maximum of 5 percent cortex retention, a somewhat ovate plan view form, and a slightly rectangular or trapezoidal cross section. The flake residues are more numerous, smaller, reduced in frequency of cortex-backed specimens, and exhibit discernible patterning of previous flake removal scars on the secondary flake's dorsal view configuration.

Stage three reduction shows no cortex remaining, overlapping flake scars forming opposing lateral margins, definite lenticular cross section, and a more elongated plan view morphology. Because of the overall loss of mass in this reduction stage, the specimens are now increasing in susceptibility to breakage due to end shock phenomenon. The manufacturer will often switch from percussion to pressure flaking fabricator devices for the remaining sequences. The flake residues show an increase in frequency of very small flakes resulting from the necessity to "set up" detachment angles and platforms along the lateral margins. The flakes will exhibit very complex dorsal scar configurations due to the multiple-course previous flake removals and they will decrease in overall curvature and thickness.

Stage four specimens are attaining the desired stylistic form and size as considered and regulated by the artisan's traditional requirements. Flake removals are very regular, deliberate, and formal. All lateral edges are uniform, the cross section is very lenticular, and the length, width, and thickness ratios are optimal. Flake residues are greatly reduced in size and frequencies and exhibit previous patterned flake scars-- predominantly from stage three with limited evidence of stage two flake removals.

Stage five reduction is the final modification sequence. Additional stylistic or functional characteristics are applied. These include last-row edge refinements, such as serrating, basal thinning, or fluting, and application of basal concavities or hafting tangs and notching. Flake residues are small and

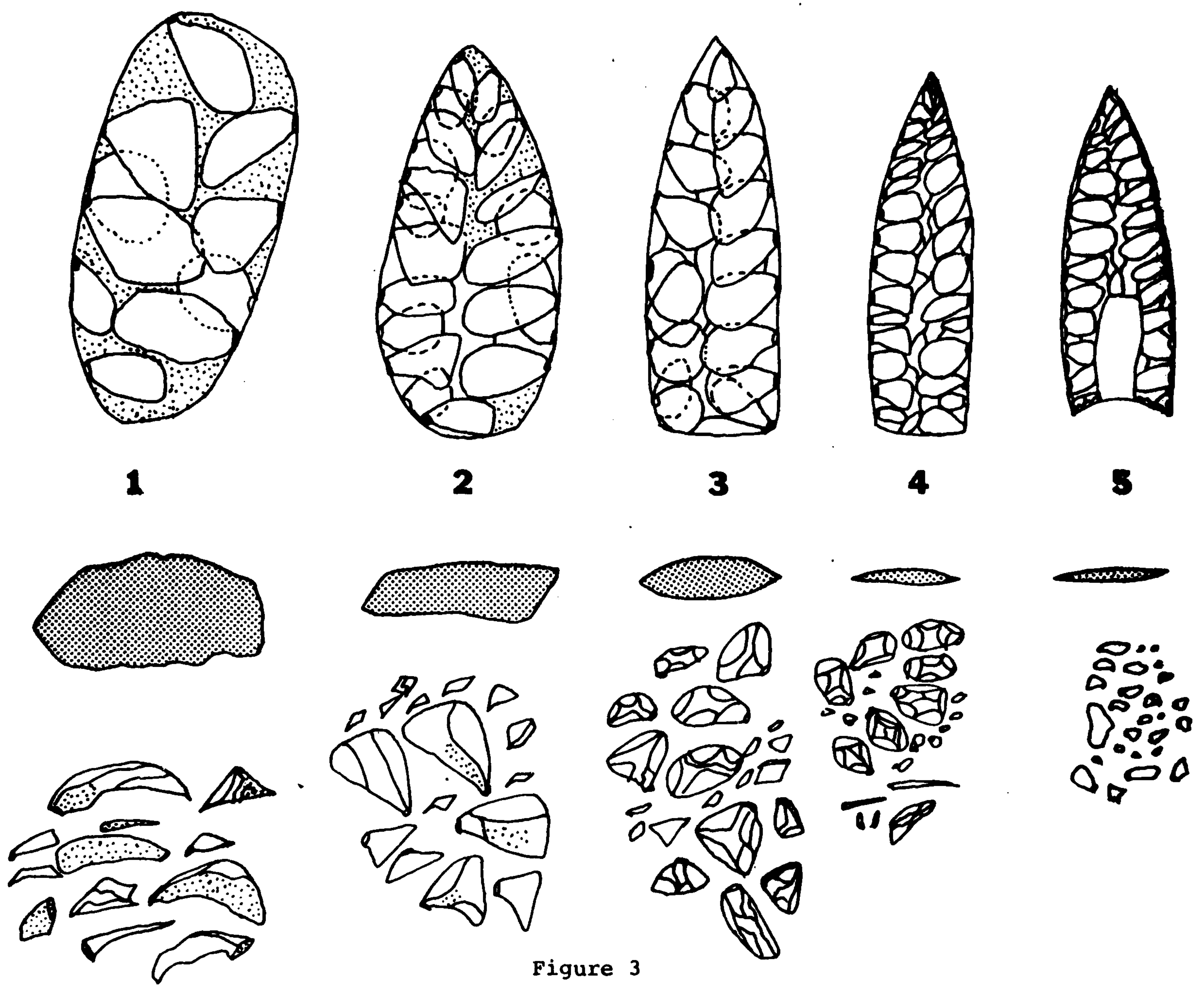


Figure 3
Illustrated above are hypothetical reduction sequences for biface production. The designs are examples of the varying flake removal forms and residual evidence.

infrequent and may be very difficult to detect when recovered in an archaeological context.

The above description represents only one of many approaches to biface production. For example, another sequence which has been observed within the study area and documented elsewhere exhibits biface forms that are generated from a macro-flake work piece. The residual flakes and flake scar patterning will appear significantly different in the observable record. Considering that one side of the original work piece will begin cortex free, the first row of flake removals from that side will appear as secondary flakes, except for possible cortex remnants on the striking platform and fabricator contact area (as the margin meets with the opposing face which has cortex). Also, the dorsal ridge line of the arris configuration will be limited and rudimentary depending upon the patterning or degree of overlapping flake removals. The latter is potentially important in the study of idiosyncratic behavior of individual artisans and could also aid in regional demographic investigations.

This macro-flake approach will show only half as many decortical flakes as the reduction sequence previously discussed. Also, the ventral face of the macro-flake work piece will probably be fairly flat at the start and not require as much reduction. The ultimate finished product will therefore retain the key evidence of this reduction strategy in the form of an area toward the center of one face that will be free of flake scars, thereby indicating the ventral surface of the original flake-based work piece. This condition will follow except where application of a last row of flake removals is added for aesthetic or traditional purposes. The latter, however, would not be the rule, and therefore the opportunity to document this differing technology will likely be retained in the archaeological record.

The experiments by Cornerstone Research show that arris configurations caused by seried flake removals have high potential for illustrating the reduction stage and methods and techniques of fabrication. Cornerstone is currently researching the range of arris configurations by compiling first, second, and third row flake removal patterns. With the application of differing flake overlap factors, various permutations of flake scar patterns provide a research method which may give rise to a solution to reconstruction problems associated with undifferentiated activity residues. An additional experimental graphic aid has also been employed to assist the researcher in reconstructing the patterning of arris configurations. This aid--graduated isometric ellipses--is used to "replace" the previous flake removals, thereby allowing a clearer picture of the available patterns of previous flake removals.

The highly variable core configurations are also important in reconstructing inter- and intrasite activities. Numerous trial group forms, based on previous knowledge of the present

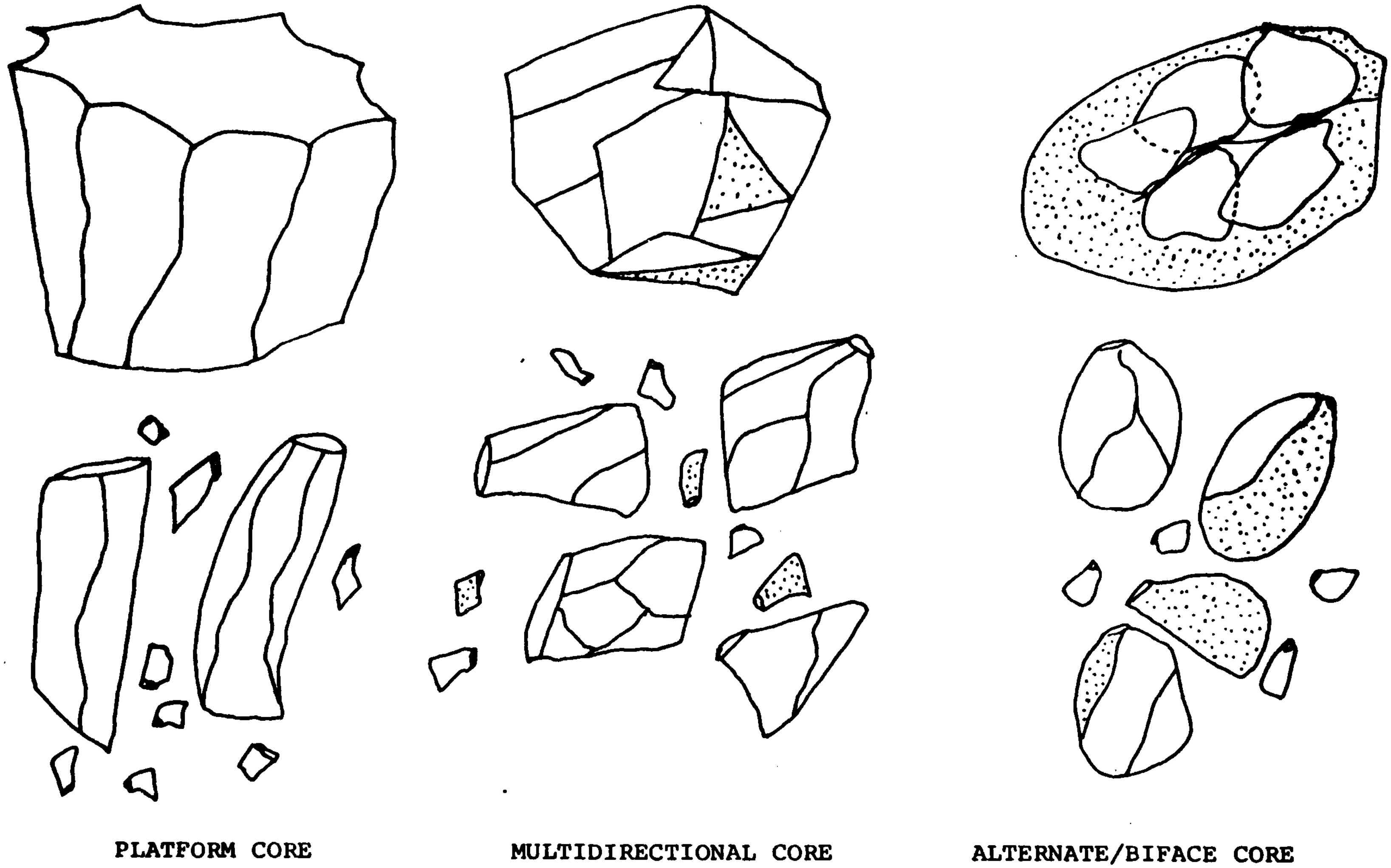


Figure 4

Illustrated above are three core configurations observed within the study area. The forms were developed to explain the effects of differing flake procurement methods. Resulting flakes are to be further reduced into various tool morphologies.

resource assemblage, have been presented for this kind of artifact. Ultimately, regularities in technology and frequencies of occurrence may verify these as true core types. However, this may require examination of very large numbers of core forms from a variety of quarries.

As noted in the trial group of core forms (Figure 4), morphology and patterning are important characteristics to monitor since the different forms facilitate different kinds of flake forms, thereby dictating discrete parameters for subsequent flake-based tool fabrication. An example of this is the difference between a platform core and a multidirectional core. Flakes resulting from platform core reduction are frequently elongated, slightly curved, and thick. Flakes removed from a multidirectional core are short, wide, and relatively thin, automatically delimiting the maximum length, width, and thickness ratios relative to subsequent tool fabrication.

The potential exists that differing core forms are contemporaneous and simply represent different tactics to obtain flakes for different tool forms. This is opposed to the distinctive temporal segregation of technological strategies for securing flakes for similar tool manufacture.

Although the findings of the current experiments are not conclusive, the primary comparison between the activity residue caused by core reduction to acquire flakes for flake-based tool manufacture and residue caused by bifacial tool reduction sequences (which shape and thin the objective piece) is as follows. Generally, far less waste flakage is associated with core reduction as less platform preparation is required due to the presence of satisfactory angles for flake detachment. This is in comparison to the necessity to set up correct platform angles in biface tool manufacture--especially in reduction stages two, three, and four. These generalizations overlap somewhat. For example, flakes removed from large biface forms to create the European Acheulean-like tools have been known to be further reduced to form other flake-based tools not involving formal cores.

In summary, the replicative experiments allowed clarification of technical nomenclature, provided generalized criteria for identification of reduction residues for differing kinds of tool forms, and assisted in formulation of the series of provisional tool and feature types used in this investigation. Cornerstone Research plans to continue analysis of these experimentally created assemblages and is currently designing additional replication studies, such as studies to distinguish assemblage differences created by novice stone workers as they become more competent "expert" status knappers, differences between left-handed and right-handed knappers, use of hard wood fabricators, and attrition and recovery rate studies. The goal is to apply experimentally devised evidence to culturally related data recovered from an archaeological context.

SECTION V

RESULTS OF INVESTIGATION

INTENSIVE PEDESTRIAN SURVEY

The area intensively surveyed by Cornerstone Research within the Live Fire Maneuver Range (LFMR) consists of one zone which follows Silver Lake Road for approximately 14.5 kilometers and another zone lying along the southern boundary of the LFMR (Figure 5). Most of the survey area is a narrow corridor along Silver Lake Road, ranging from 250 to 750 meters wide, with a 4,000-meter-wide area in the central portion of the study zone. A large area in the northern half and two small hills in the north-central portion had been previously surveyed and were eliminated from the current reconnaissance. An additional survey area, designated the High Pass Road region, lies to the west of the southern portion of Silver Lake Road. Total area surveyed during this project is approximately eleven square kilometers.

Most of the area surveyed consists of gently sloping alluvial fans along the bases of low rolling hills. The central and southern portions are more heavily dissected by intermittent wash and drainage channels than the northern third. Patches of desert pavement occur sporadically throughout the central and southern thirds, primarily in the more dissected areas at the bases of the hills. The largest, most well-developed desert pavement covers a large portion of the southern survey area, although this pavement has been highly impacted by vehicle tracks and dirt roads and by erosion associated with Bow Willow Wash. Vegetation throughout the survey area consists of species typical of the creosote bush scrub plant community. Military vehicle tracks and debris were observed, in varying intensities, throughout the study zone. Silver Lake Road has also created impacts, and extensive grading associated with several stationary military targets has occurred in the northern section of the area.

The intensive pedestrian survey resulted in the location and recordation of twenty-one sites and sixty-seven isolated finds (see Table 6). In the discussion that follows, these cultural resources are presented in tabular form and briefly described. Further analyses are also provided in Section VI of this report. Concise site description, condition, and location for each resource have been recorded but are not available for review by the general public. These data have been provided to the Interagency Archeological Services Division as separate documents to facilitate proper resource management and continuing anthropological research. A complete survey record, artifact collection, and report are currently on file at Cornerstone Research and are available for future consideration by qualified researchers.

Table 6
SILVER LAKE ROAD SURVEY
SITE SUMMARIES

Site No.	Description	Disposition/ Drawn, Photographed
	Sites	
4-SBr-4727	1 rock cairn, 1x0.8 m, 15 granodiorite rocks, 1 course high	Left in situ Drawn, Photographed
4-SBr-4728	1 rock cairn, 1x0.75 m, primarily granitic, 2 courses	Left in situ Photographed
4-SBr-4729	Complex containing flake scatters and core reduction stations, 34x15 m, 120+ flakes/debitage, 2 cobble-based tools, 6+ cores, all chalcedony	Left in situ Drawn, Photographed
4-SBr-4730	Lithic scatter, 20x15 m, 1 tool, 8 cores, 66+ flakes, all chalcedony	Left in situ Drawn, Photographed
4-SBr-4732	Lithic scatter, 115x40 m, 300+ chalcedony flakes/debitage, 20 bifacially worked flakes, 1 basalt core, 1 chalcedony core	Left in situ Drawn, Photographed
4-SBr-4733	Lithic scatter, 4.5x4.25 m, 60+ flakes, 2 cores, 1 truncated biface fragment, all chalcedony	Left in situ Drawn, Photographed
4-SBr-4734	Lithic scatter, flake scatters, reduction areas, isolated artifacts, 100+ flakes, 2 cores, 3 bifaces, 1 bifacially flaked scraper-like tool, all chalcedony	Left in situ Drawn
4-SBr-4735	Lithic scatter, 12x35 m, 13+ flakes, 2 cores, all chalcedony, 1 probably recent rock ring	Left in situ Drawn, Photographed
4-SBr-4736	Lithic scatter, 25x65 m, 100+ flakes, 2 cores, chalcedony (predominant), chert, obsidian, 1 chalcedony projectile point tip	Left in situ Drawn, Photographed
4-SBr-4741	1 rock cairn, 1 m diameter, 83 cm high	Left in situ Photographed
4-SBr-4742	1 flake scatter, 36x12 m, 14 flakes, 1 unifacially flaked tool, 1 core, all chalcedony	Collected Drawn
4-SBr-4743	Lithic scatter, 50x35 m, 1 core, 48 flakes, all chalcedony	Collected Drawn, Photographed
4-SBr-4744	Flake scatter, 36x36 m, 30 chalcedony flakes	Left in situ Drawn, Photographed

Table 6
SILVER LAKE ROAD SURVEY
SITE SUMMARIES
(continued)

Site No.	Description	Disposition/ Drawn, Photographed
4-SBr-4745	Core reduction station, 31x10 m, 4 cores, 54+ flakes, 1 tool (possible burin), all jasper	Tool collected Drawn, Photographed
4-SBr-4746	Large site complex, 12 loci of core reduction centers, lithic scatters, grinding implements, 212.5x75 m, artifacts include 450+ flakes, 25+ cores, 3 bifaces, several utilized flakes, scrapers, 15 bifacially flaked tools, 1 unifacial tool, 1 flake-based chopping tool, 1 hammer, 1 groundstone, 4 metates, 2 manos, 10+ flaked lithic implements, lithic materials include chalcedonies (predominant), quartzite, basalt, andesite, felsite	Left in situ Drawn, Photographed
4-SBr-4747	1 rock cairn, 1.1 m diameter, deflated, 30 granodiorite stones	Left in situ Drawn, Photographed
4-SBr-4748	1 rock cairn, 6 stacked rocks, 59x52 cm, 60 cm high, additional 12 rocks once aspect of cairn, overall area 1.8x1.6 m	Left in situ Drawn, Photographed
4-SBr-4749	Lithic reduction station, 3x1.5 m, 30-40 primary chalcedony flakes	Left in situ Drawn, Photographed
4-SBr-4750	Core reduction station, 3x5 m, 9 flakes, 5 cores, 1 biface fragment, 1 bifacially flaked tool fragment, all 2 varieties of chalcedony	Tool collected Drawn
4-SBr-4751	Rock ring, 3 m diameter, basalt stones, other possible rock features in vicinity, 1 utilized chalcedony flake 26 m north	Left in situ Drawn, Photographed
4-SBr-4752	Complex of 3 loci and 1 associated isolate, 53x7 m, 100+ chalcedony flakes/debitage, 1 basalt flake, 1 chalcedony ovate biface, 1 unifacial felsite scraper, 1 chalcedony tool	Left in situ Drawn, Photographed
	Isolated Finds	
SBCM-4978	1 isolated chalcedony flake	Collected
SBCM-4979	1 isolated chalcedony flake	Collected

Table 6
SILVER LAKE ROAD SURVEY
SITE SUMMARIES
(continued)

Site No.	Description	Disposition/ Drawn, Photographed
SBCM-4980	1 isolated utilized chalcedony flake	Collected Photographed
SBCM-4981	1 utilized chalcedony flake, 1 debitage	Collected Photographed
SBCM-4982	1 isolated utilized chalcedony flake	Collected Photographed
SBCM-4983	1 isolated chalcedony biface/knife fragment	Collected Photographed
SBCM-4984	2 chalcedony cores, 6 chalcedony debitage, 1.35x0.4 m	Collected Drawn, Photographed
SBCM-4985	1 isolated chalcedony flake with use wear evidence, 1 isolated chalcedony biface/ knife, 47 cm apart	Collected Drawn, Photographed
SBCM-4986	1 isolated chalcedony typological blade (evidence of edge damage)	Collected Photographed
SBCM-4987	1 chalcedony debitage, 1 primary chalcedony flake, 2.5 m apart	Collected Drawn, Photographed
SBCM-4988	1 isolated secondary chalcedony flake	Collected Photographed
SBCM-4989	9 primary chalcedony flakes, 3 secondary chalcedony flakes, 0.5x0.6 m	Left in situ Drawn, Photographed
SBCM-4990	1 isolated primary chalcedony flake	Collected Photographed
SBCM-4991	1 isolated secondary jasper flake	Collected Photographed
SBCM-4992	1 isolated utilized jasper flake, broken into 2 pieces	Collected Photographed
SBCM-4993	1 isolated historic pick head, 40 cm long, 6 cm thick, highly rusted	Collected Photographed

Table 6
SILVER LAKE ROAD SURVEY
SITE SUMMARIES
(continued)

Site No.	Description	Disposition/ Drawn, Photographed
SBCM-4994	1 isolated utilized quartz flake	Collected Photographed
SBCM-4995	1 isolated secondary chalcedony flake	Collected
SBCM-4996	1 isolated utilized chalcedony flake	Collected
SBCM-4997	2 isolated primary chalcedony flakes, 1 isolated secondary chalcedony flake, 12 m apart	Collec l Drawn
SBCM-4998	1 isolated primary chalcedony flake, 1 isolated utilized chalcedony flake	Collec
SBCM-4999	2 isolated chalcedony flakes, 1 chalcedony amorphous core, within 25 cm of each other	Collected Drawn, Photographed
SBCM-5000	1 primary jasper flake, 1 secondary jasper flake, 1 utilized chalcedony flake, 2.5 and 5 m apart	Collected Drawn, Photographed
SBCM-5001	1 isolated cobble-based tool, evidence of battering, porphyritic andesite	Collected Photographed
SBCM-5002	Core reduction station, 8x8 m, 3 multidirectional cores, 14 debitage, all chalcedony	Collected Drawn, Photographed
SBCM-5003	Lithic scatter, 2.5x1 m, 1 multidirectional core, 5 primary and 3 secondary flakes, all chalcedony	Collected Drawn, Photographed
SBCM-5004	Isolated lithic scatter, 1.5x0.75 m, 2 cores, 5 flakes, all chalcedony	Left in situ Drawn
SBCM-5005	1 isolated chalcedony biface fragment,	Collected Photographed
SBCM-5006	2 isolated chalcedony flakes (1 utilized), 10 m apart	Collected Drawn, Photographed
SBCM-5007	1 isolated chalcedony debitage	Collected Photographed
SBCM-5008	1 isolated chalcedony flake	Collected
SBCM-5009	1 isolated secondary chalcedony flake	Collected

Table 6
SILVER LAKE ROAD SURVEY
SITE SUMMARIES
(continued)

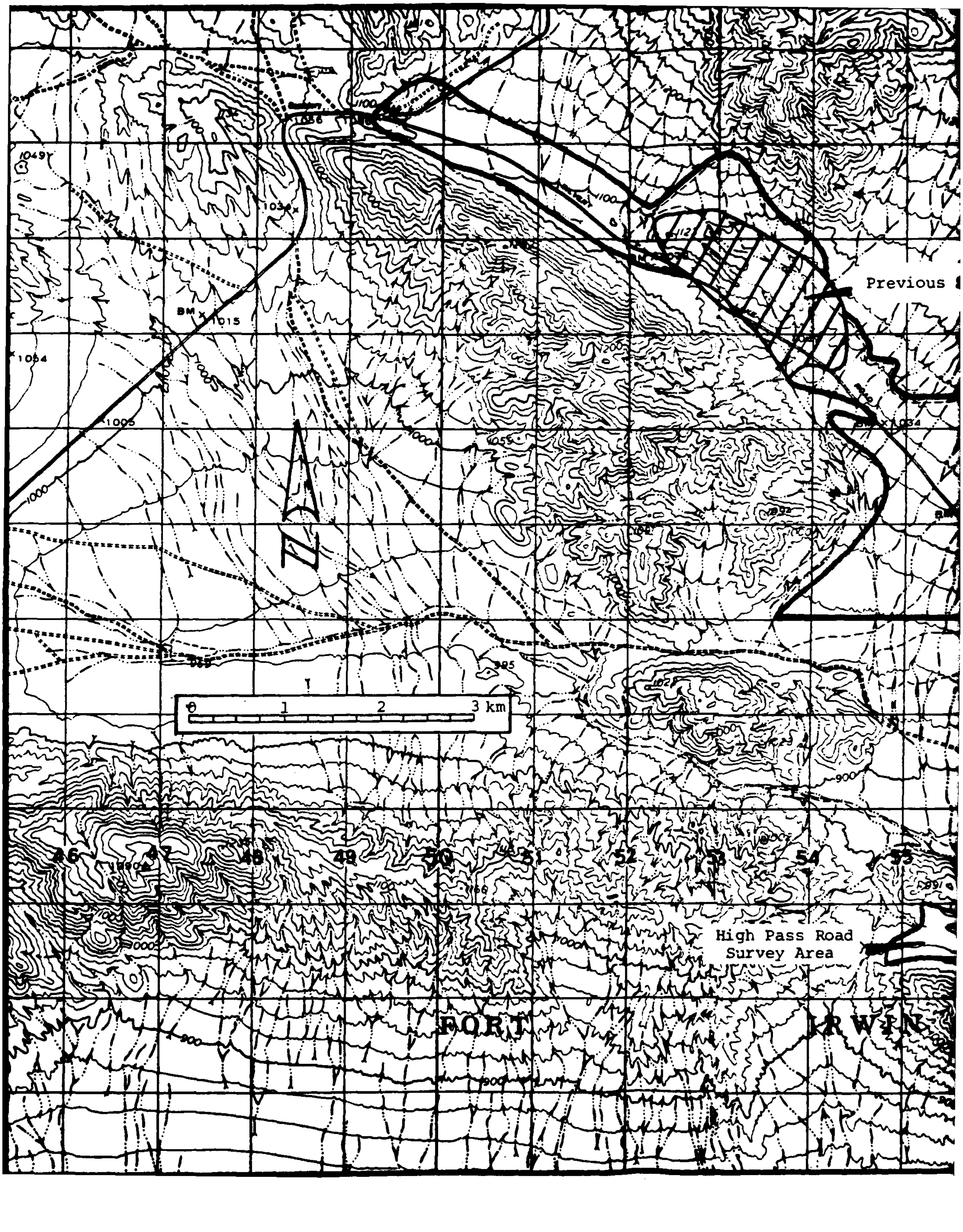
Site No.	Description	Disposition/ Drawn, Photographed
SBCM-5010	1 isolated chalcedony secondary flake	Collected
SBCM-5011	1 isolated unifacial chalcedony tool, 1 projectile point fragment, 70 cm apart	Collected Drawn, Photographed
SBCM-5012	Isolated lithic reduction station, 1x0.5 m, 8 debitage, 2 primary flakes, 2 multidirectional cores, all chalcedony	Collected Drawn
SBCM-5013	Isolated lithic reduction station, 0.7x0.5 m, 3 multidirectional cores, 2 debitage, 1 secondary flake, 2 primary flakes, all chalcedony	Collected Drawn, Photographed
SBCM-5014	1 isolated amorphous quartzite core	Collected Photographed
SBCM-5015	1 metate, bifacially ground, granodiorite	Collected Photographed
SBCM-5016	1 isolated chalcedony debitage	Collected Photographed
SBCM-5017	Isolated flake scatter, 3.5x1 m, 1 porphyritic basalt flake, 2 secondary and 5 primary chalcedony flakes	Collected Drawn, Photographed
SBCM-5018	1 metate, 43x33x7 cm, granodiorite, irregular shape, slight unifacial grinding	Collected Photographed
SBCM-5019	6 pieces purple glass	Collected
SBCM-5020	1 isolated primary chalcedony flake with use wear evidence	Collected Photographed
SBCM-5021	2 isolated secondary chalcedony flakes (1 utilized), 5 m apart	Collected Drawn, Photographed
SBCM-5022	1 isolated utilized andesite flake	Collected Photographed
SBCM-5023	1 isolated chalcedony flake	Left in situ Photographed
SBCM-5024	1 isolated flake-based unifacial chalcedony tool	Collected

Table 6
SILVER LAKE ROAD SURVEY
SITE SUMMARIES
(continued)

Site No.	Description	Disposition/ Drawn, Photographed
SBCM-5025	1 isolated secondary chalcedony flake	Collected
SBCM-5026	1 isolated chert flake	Left in situ
SBCM-5027	1 isolated unidirectional chalcedony core, 1 debitage	Collected
SBCM-5028	1 isolated secondary chalcedony flake	Collected
SBCM-5029	1 isolated flake-based biface	Collected Photographed
SBCM-5030	Isolated flake scatter, 0.6x0.4 m, 7 chalcedony debitage	Collected Drawn, Photographed
SBCM-5031	1 isolated primary chalcedony flake	Collected
SBCM-5032	1 isolated primary chalcedony flake	Collected Photographed
SBCM-5033	1 isolated secondary chalcedony flake	Collected Photographed
SBCM-5034	2 isolated chalcedony artifacts, 1 multidirectional core, 1 utilized flake, 65 cm apart	Collected Drawn, Photographed
SBCM-5035	1 isolated flake-based, unifacial jasper tool	Collected Photographed
SBCM-5036	1 isolated chalcedony debitage	Collected Photographed
SBCM-5037	1 isolated primary chalcedony flake	Collected
SBCM-5038	1 isolated chalcedony secondary flake, 1 isolated chalcedony debitage, 2 m apart	Collected Drawn
SBCM-5039	1 isolated andesite debitage	Collected Photographed
SBCM-5040	1 isolated primary chalcedony flake	Collected Photographed

Table 6
SILVER LAKE ROAD SURVEY
SITE SUMMARIES
(continued)

Site No.	Description	Disposition/ Drawn, Photographed
SBCM-5041	1 isolated chalcedony primary flake, 1 isolated multidirectional core, 10 cm apart	Collected Drawn
SBCM-5042	1 isolated chalcedony debitage	Collected
SBCM-5043	2 isolated chalcedony debitage, 2 m apart	Collected
SBCM-5044	1 isolated primary chalcedony flake	Collected Photographed



Previous
High Pass Road
Survey Area
FORT
IRWIN
0
1
2
3 km
46
47
48
49
50
51
52
53
54
55

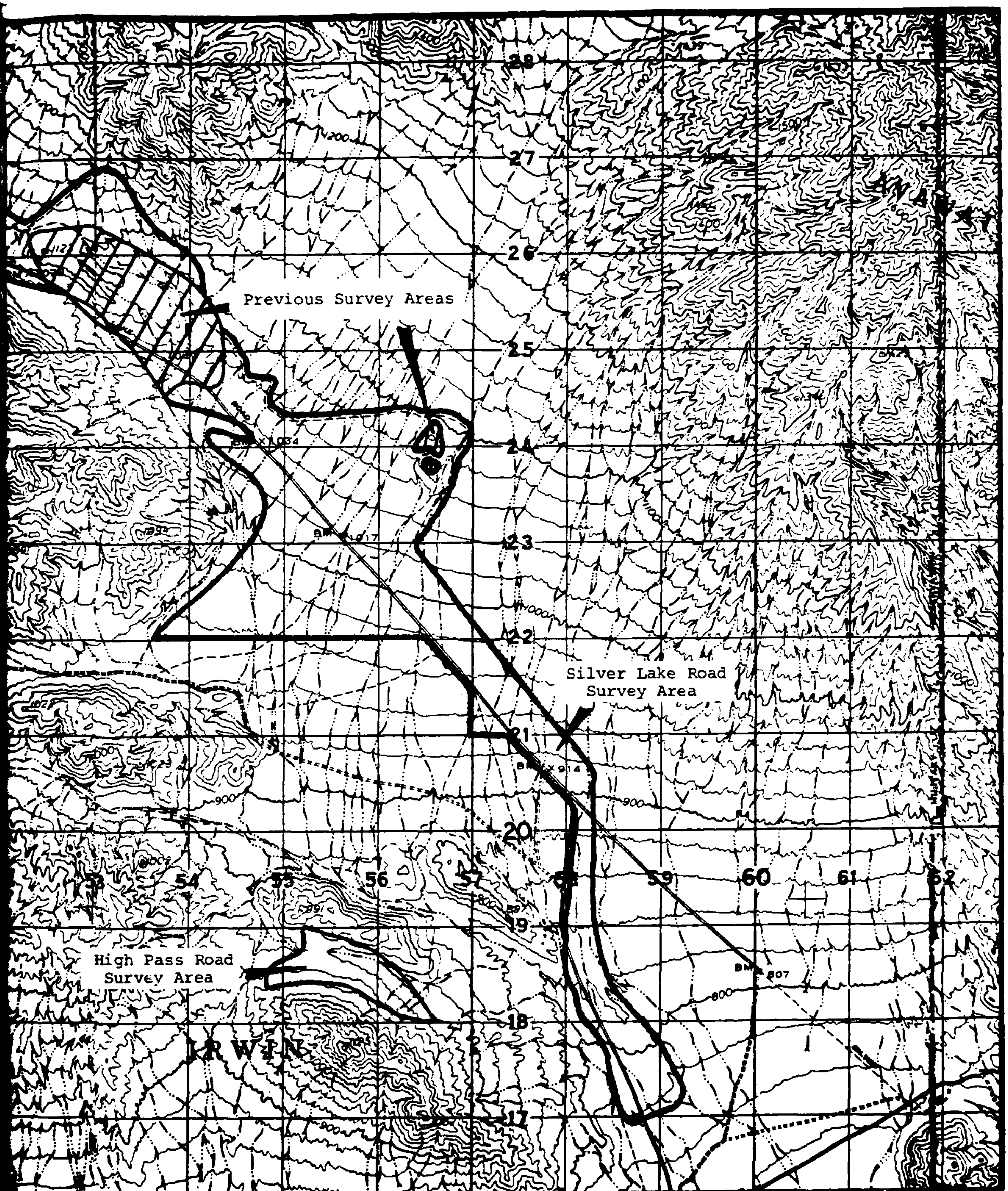


Figure 5

reas are outlined on the above map. The stippled areas had been previously
connaissance. The map is based on the DMATC topographic map series, Red Pass

1 2

The isolated finds recorded during this aspect of the project range from single artifacts to small lithic scatters. Twenty-nine of these finds are single chalcedony flakes, eight evidencing utilization. Two andesite flakes were also located. Eight tools were recovered, five of chalcedony and most with evidence of patterned, bifacial flaking. The remaining single artifacts consist of one chalcedony projectile point fragment, one chalcedony typological blade fragment, two metates, one historic miner's pick head, and six pieces of purple glass.

Thirteen of the recorded isolates are light-density flake scatters consisting of two or three artifacts, primarily chalcedony flakes. The remaining nine scatters involve higher-density clusters of artifacts, including light concentrations of seven to twelve flakes and several scatters of two or three cores and five to fourteen associated flakes. Most of these materials were plotted in the field and removed for more detailed flaked lithic artifact analysis.

A variety of sites was recorded in the survey area, ranging from small, relatively light-density flaked lithic scatters to site complexes containing a series of loci of flaked lithic material scatters and core reduction stations. Five rock cairns were also recorded, but none have any definitive evidence indicating historic or prehistoric origin. A rock ring recorded in the small western survey area is composed of basalt stones and may have several additional rock features in the vicinity.

Most of the sites recorded as flaked lithic scatters involve several cores and from 30 to 300 flakes, both primary and secondary. These sites also include bifacially worked tools, bifaces, scrapers, and bifacially worked or utilized flakes. The predominant lithic material is chalcedony, although basalt and andesite were also noted and one jasper core reduction area was documented.

Three more extensive site complexes were located and recorded within the area. These include artifacts similar to those described above, but involve larger areas containing series of associated loci of flaked lithic scatters and core reduction stations. Grinding implements--metates and manos--and a larger variety of tool types were also observed within these site areas.

Details are presented below for the sites recorded during the current investigation. The physiographic setting of each site is briefly discussed, followed by a description of the cultural artifacts and features noted. The accompanying site maps (Figures 6-26) graphically present the cultural resources as observed and sketched during the field reconnaissance. Refer to Appendix A, Figure 1, for specific locations and boundaries of these sites.

4-SBr-4727, Rock Cairn. This rock feature is located on the wide alluvial fan area north of Silver Lake Road at an approximate elevation of 3050 feet above mean sea level. Numerous intermittent drainages occur throughout the general area, although none was noted in the immediate vicinity. The feature is a somewhat deflated rock cairn, 1x0.8 meters in area, consisting of fifteen various-size rocks, primarily granodiorite and gneiss (Figure 6). The stone elements are arranged in one course and are partially embedded. No prehistoric artifacts were observed in the area of the cairn, implying a historic origin of the feature.

4-SBr-4728, Rock Cairn. Located approximately 200 meters east of SBr-4727 at an elevation of 3050 feet, this rock feature is also situated on the wide, dissected alluvial fan north of Silver Lake Road. The overall feature encompasses an area of 1x0.75 meters and is composed of about eight stone elements (Figure 7). Several of the smaller stones are arranged around a large central boulder, on top of which are stacked two additional stones. The rocks are primarily of granitic material. As with SBr-4727, a historic origin is assumed for this feature due to the lack of associated prehistoric artifacts.

4-SBr-4729, Flake Scatters/Core Reduction Stations. This site complex is situated at an elevation of 2620 feet on a well-developed but disturbed desert pavement 150 meters west of the Silver Lake Road extension and about 250 meters east of Bow Willow Wash on a cut bank above the wash. Numerous additional cultural resources are located and recorded throughout the area, including SBr-4730 fifty-two meters to the northwest, which is possibly associated with this site.

The site consists of three core reduction stations, two flake scatters, and several outlying artifacts over an area 20x20 meters (Figure 8). Artifacts noted within these loci include more than 120 secondary and primary flakes and debitage, cobble-based tools, multidirectional, patterned, and amorphous cores, and a modified flake.

The largest core reduction locus, in the western portion of the site, contains over thirty flakes and two associated cores. To the northeast 3.5 meters is another core reduction station of eighteen flakes and one core. The third core reduction locus, in the southeastern extreme of the site, is a loosely associated scatter of one patterned core, six flakes, and one modified flake. The flake scatters consist of ten primary flakes in the northern area of the site and several additional flakes and a cobble-based tool just southwest of the site datum. All of the cultural materials are of chalcedony, approximately 60 percent are embedded in the desert pavement, and no prominent oxidation or patination is evident on the artifacts. Forty percent of the flakes are primary flakes.

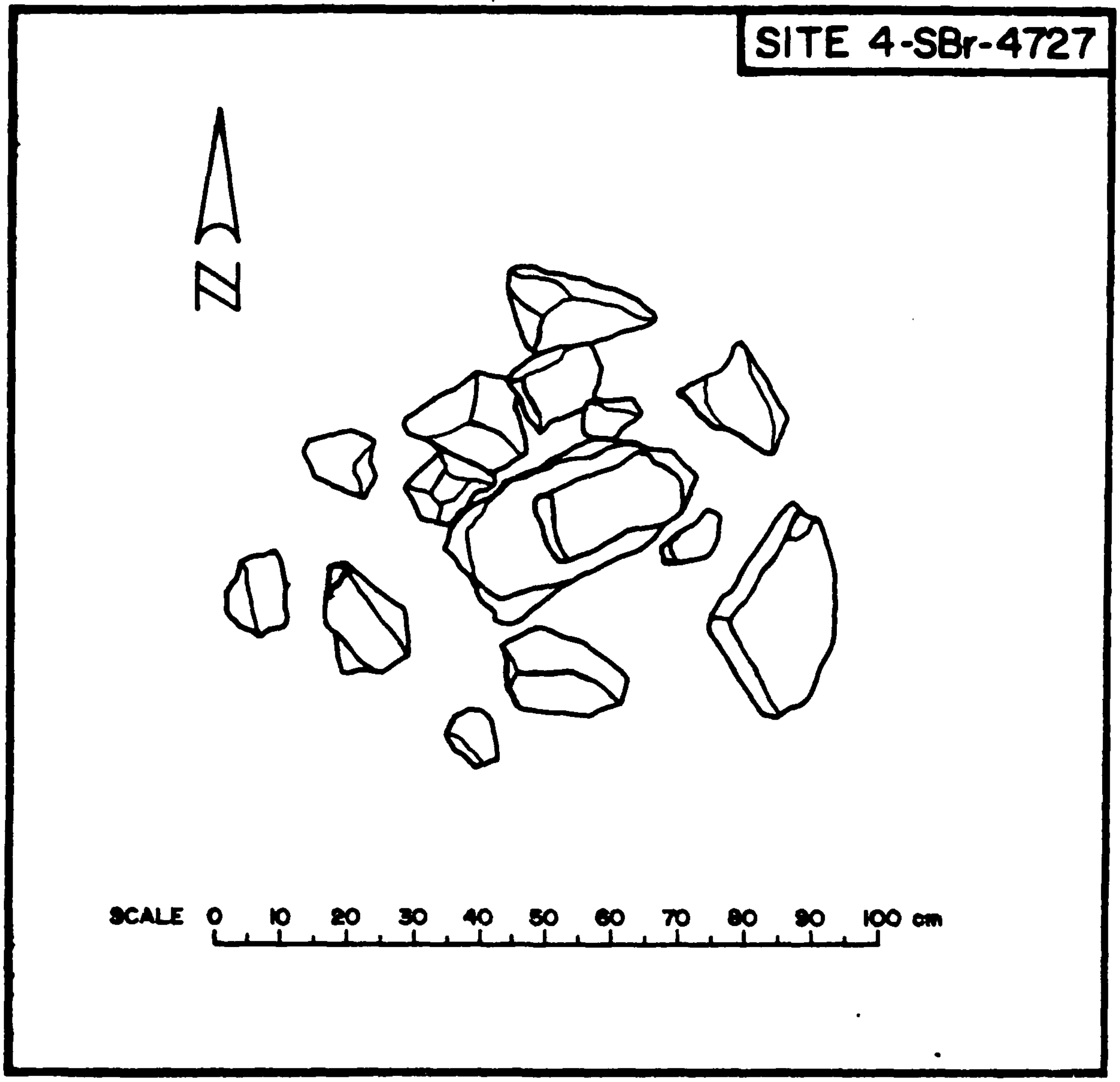


Figure 6

Field sketch of 4-SBr-4727, as described in the text. See Appendix A for specific site location.

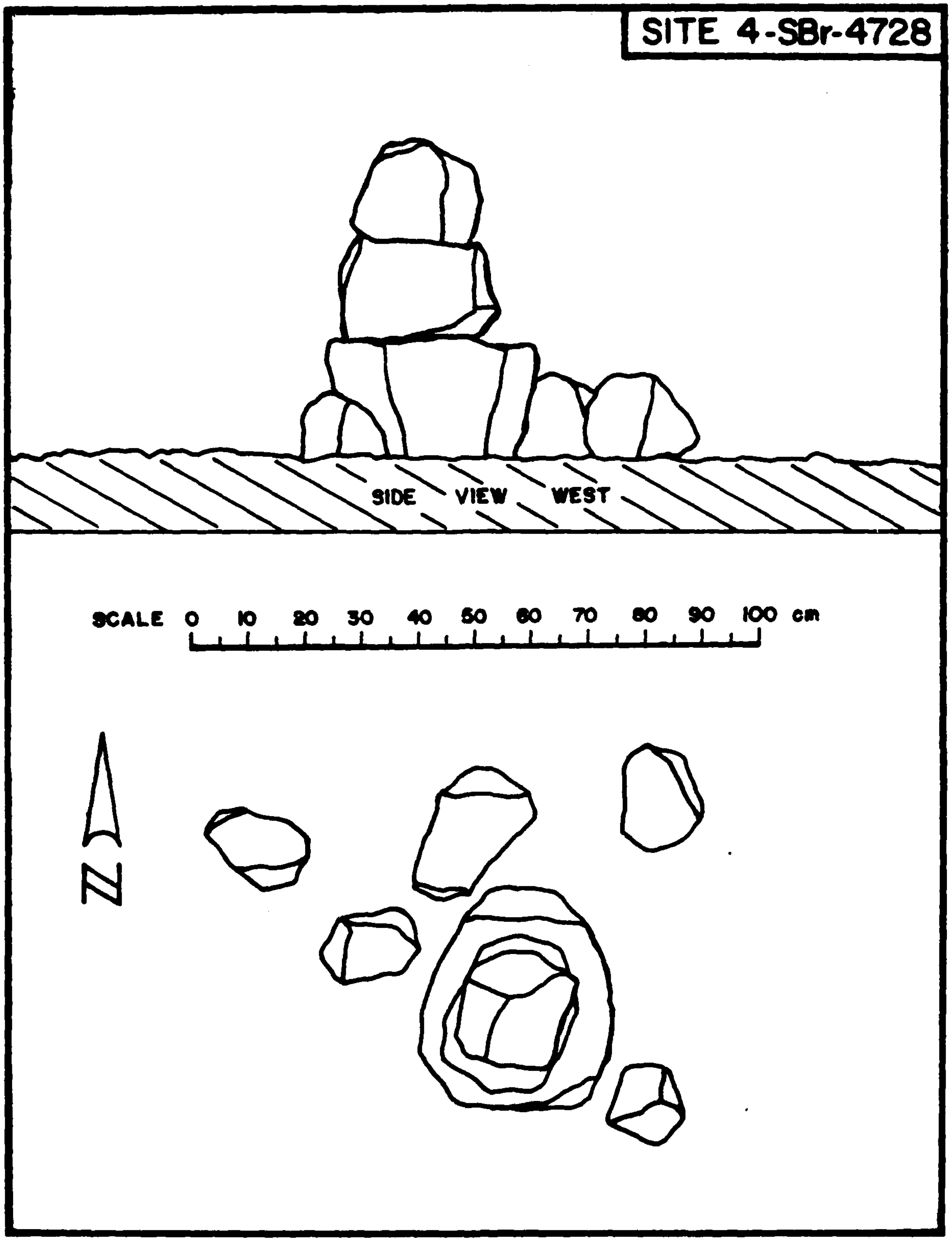


Figure 7

Field sketch of two views of 4-SBr-4728, as described in the text. See Appendix A for specific site location.

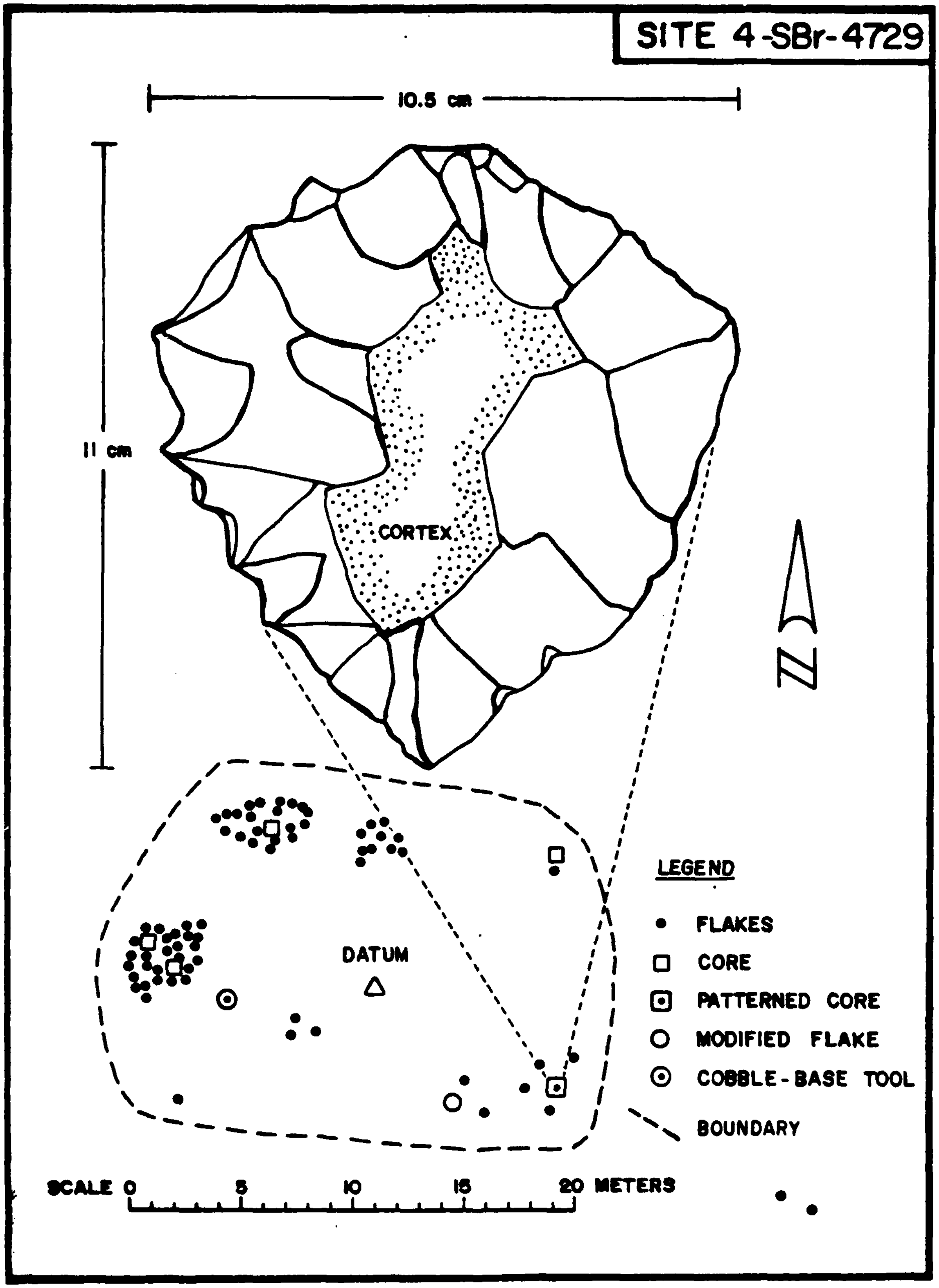


Figure 8

Field sketch of 4-SBr-4729 and patterned core as described in the text. See Appendix A for specific site location.

Although no artifacts were collected from the site materials, several detailed drawings were provided during the survey recordation. A core with patterned bifacial flake removals, noted in the southeastern core reduction station, is illustrated in Figure 8. Also recorded in the field was a modified flake, 2.8x2.3 centimeters in size, with evidence of utilization along three edges.

4-SBr-4730, Flaked Lithic Scatter. Located on the cut bank east of Bow Willow Wash, this site is situated at 2625 feet above mean sea level. It is 150 meters west of the Silver Lake Road extension and about 200 meters east of Bow Willow Wash on a well-developed, disturbed desert pavement. Similar cultural resources were located and recorded throughout this area, including SBr-4729, a possibly associated complex of flake scatters and core reduction stations fifty-two meters to the east.

The site encompasses an area of approximately 20x15 meters and contains over sixty-six primary flakes, eight cores, and one utilized flake, all of chalcedony (Figure 9). Although several concentrations of these artifacts are evident throughout the site area, most of the cultural materials occur as scattered artifacts with no definitive core reduction concentrations. However, area site disturbance may have disrupted such once-existing concentrations. Most of the artifacts are partially embedded within the pavement surface. No artifacts were removed from the site during the field survey.

4-SBr-4732, Flaked Lithic Scatter. This large flaked lithic scatter is located at about 3600 feet elevation 105 meters south of Silver Lake Road and approximately 500 meters southeast of the intersection of Silver Lake Road and the dirt road to Cave Springs. It is situated on a relatively flat portion of an alluvial fan along the northern base of a ridgeline of low hills. A moderate northeast-trending intermittent drainage occurs about 250 meters northwest of the site. The site area has been disturbed by a well-developed dirt road along the northern extreme of the site and military tank tracks throughout the area.

As illustrated in Figure 10, the site is approximately 115 meters long and 40 meters wide at its widest aspect. Observed artifacts include over 300 flakes and debitage, some 20 bifacially worked flakes, and several large cores (not all depicted in Figure 10). Lithic materials are a wide variety of chalcedonies (the predominant material), jasper, black basalt, and chert. Only 10 percent of the flakes have cortex remaining on the outer surface, indicating a prevalence of secondary flakes at this resource. Most of the artifacts are slightly or not embedded in the surface soils.

Although no artifacts were collected form the field during recordation of this site, detailed observations were made of

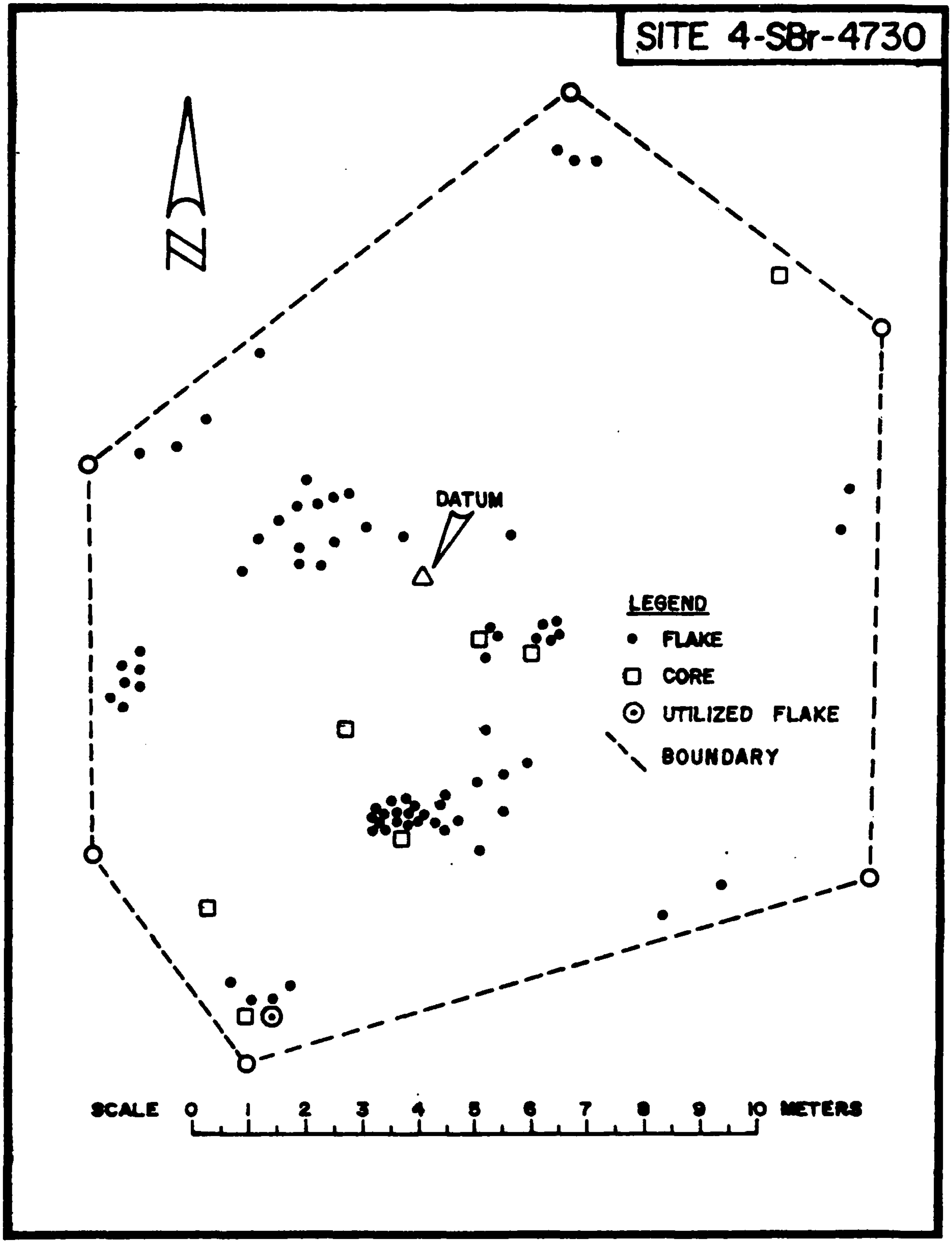


Figure 9

Field sketch of 4-SBr-4730, as described in the text. See Appendix A for specific site location.

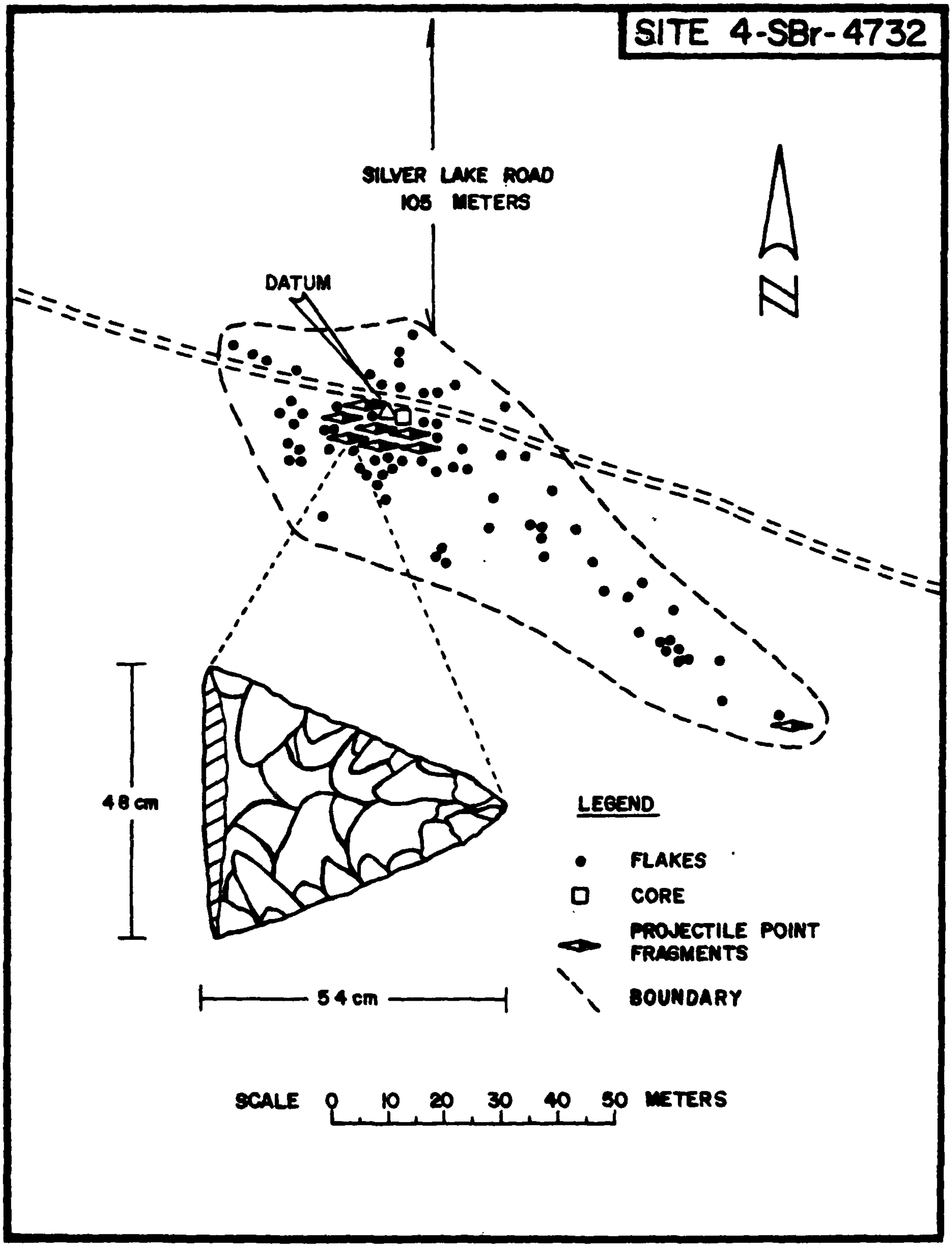


Figure 10

Field sketch of 4-SBr-4732 and stage 3 biface fragment, as described in the text. See Appendix A for specific site location.

several artifacts. A large core of black basalt was noted which measures 13x10x6 centimeters. About 25 percent of the core surface is cortex. Another core was observed of opaque chalcedony, measuring 6x6x3 centimeters with 10 percent remaining cortex. Figure 10 illustrates a biface tip of brown opaque chalcedony. It is fragmented and has been completed through stage 3 (see replicative experimentation discussion in Section III).

4-SBr-4733, Flaked Lithic Scatter. Located in an area of numerous cultural resources, this site is at elevation of approximately 2560 feet on a cut bank just east of Bow Willow Wash. The Silver Lake Road extension occurs 200 meters to the east. As with the other sites in the area, it is situated within a disturbed, well-developed desert pavement.

Figure 11 shows the primary site concentrations in an area 5.5x2 meters. Artifacts include over sixty flakes, two cores, and one biface fragment, all of various grades of chalcedony. The cultural materials occur in three primary concentrations, one of which is the biface fragment with about sixteen associated flakes at the northern extreme of the site. The flakes at the site are primary flakes--20 to 40 percent remaining cortex was noted on most of the flakes. Artifacts are only slightly embedded in the desert pavement.

Also shown on Figure 11 is a detailed drawing of the stage 2 biface fragment. This artifact is of dark brown chalcedony, as are the associated flakes, and has a very light iron oxide stain on its underside.

4-SBr-4734, Flaked Lithic Scatters/Reduction Areas. This site complex is located toward the southern extreme of the currently surveyed area in proximity to numerous other cultural resources containing similar artifactual materials. It is at an elevation of 2560 feet in a disturbed desert pavement on the cut bank overlooking Bow Willow Wash to the west. The Silver Lake Road extension occurs about 250 meters to the east.

The site consists of a series of flake scatter and reduction area loci with associated isolated artifacts, all of a variety of chalcedonies, in an area aproximately 15x35 meters (Figure 12). Most of the flakes are small and medium in size and vary from semi-embedded to not embedded in the pavement, with slight patination or oxidation. Very little cortex is remaining on the flakes. Only two small cores were observed throughout the site area. The flaked lithic scatters range from six to twenty-five flakes per scatter, with about 100 flakes observed overall. Other artifacts include a medium-size stage 2 chalcedony biface (10x8x4 centimeters); a small chalcedony biface semi-embedded in the pavement; a bifacially flaked artifact with alternate flaking, 90 percent remaining cortex, and use wear evidence on

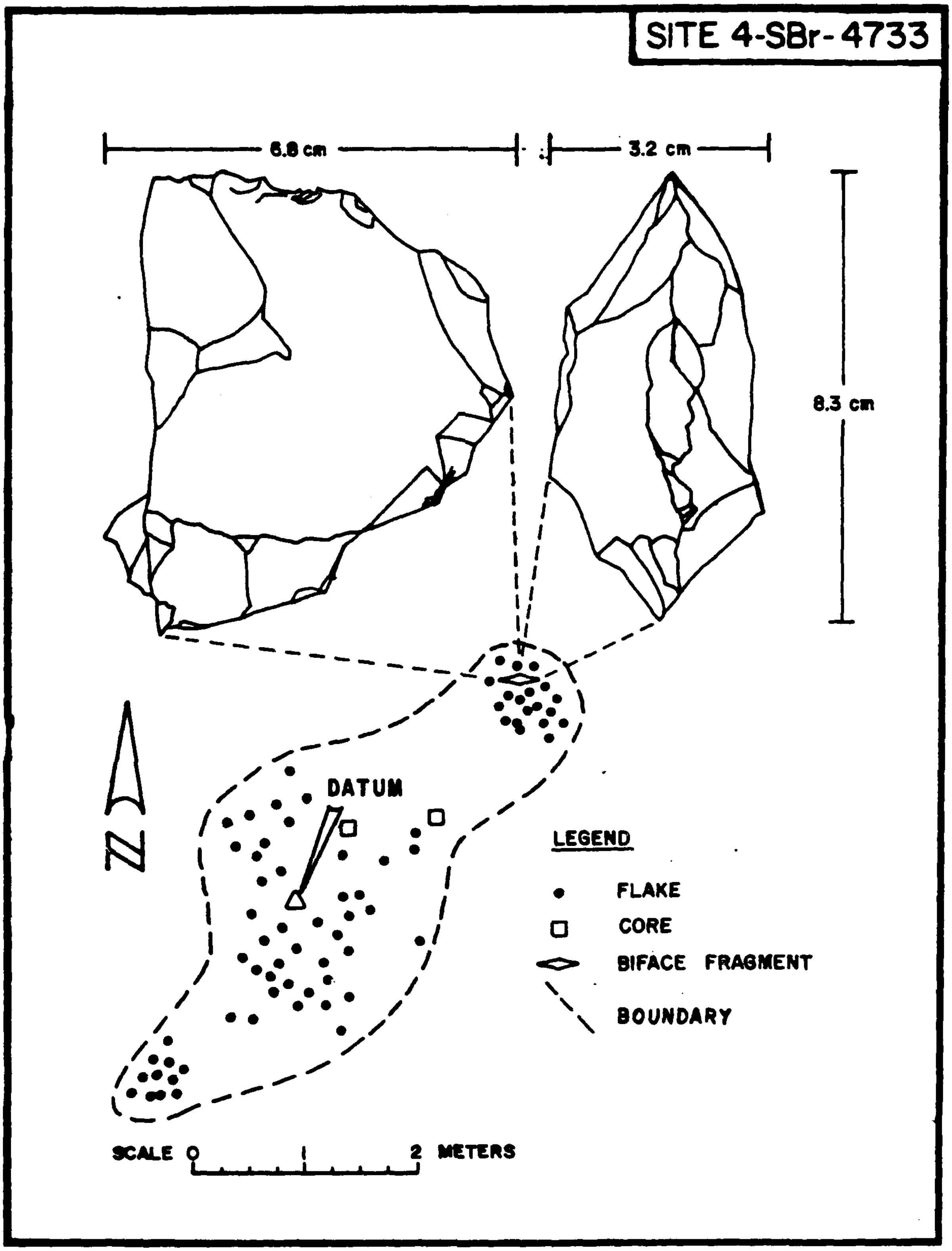


Figure 11

Field sketch of 4-SBr-4733 and a stage 2 biface, as described in the text. See Appendix A for specific site location.

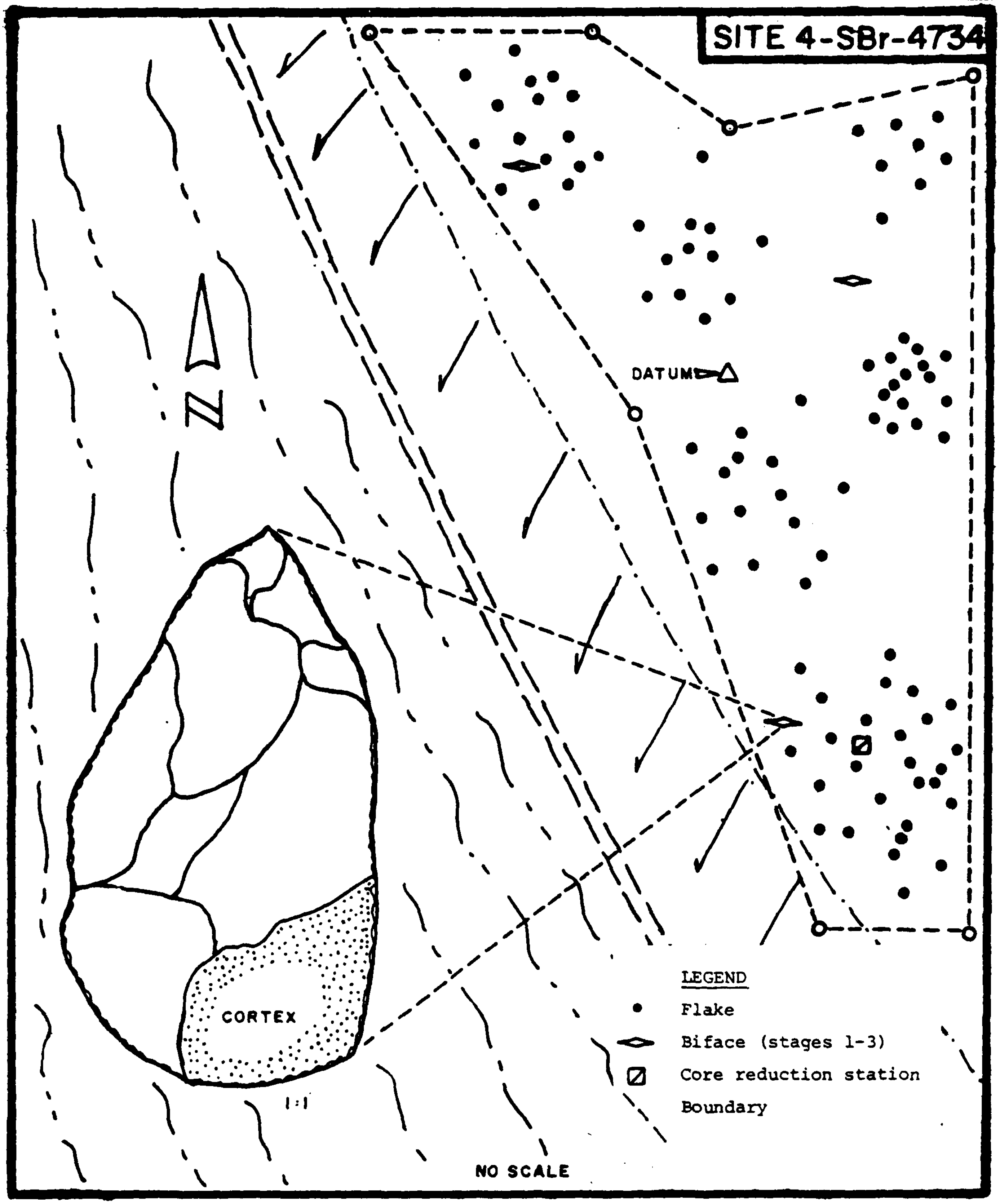


Figure 12

Field sketch of 4-SBr-4734 and stage 3 biface located at the site, as described in the text. See Appendix A for specific site location.

several edges; and a stage 1 biface with 20 percent remaining cortex and six associated flakes of the same lithic material.

Several of the reduction areas do not contain an observable core, including one concentration of nineteen thin, small flakes, another of eighteen small flakes; and a third of six larger primary flakes. A small core reduction station was recorded containing one small core and approximately fifteen associated flakes, most semi-embedded in the pavement. Another core reduction concentration contains one semi-embedded core fragment and about twenty-five non-embedded primary flakes.

Several individual artifact drawings were made during the field reconnaissance. No artifacts were removed from the field.

4-SBr-4735, Flaked Lithic Scatter. This small site is 250 meters southwest of Silver Lake Road, just south of the military buildings on Range 24. It is situated at an elevation of 3412 feet on a narrow terrace above a northeast-trending intermittent drainage thirty meters to the west within a moderately developed desert pavement.

Observed artifacts include approximately thirteen loosely scattered primary flakes and several amorphous cores, all of chalcedony and all well embedded in the desert pavement surface (Figure 13). At the southern extreme of the site is a semi-circular rock ring formation of about twenty-four medium-size stones, 2.5x2.3 meters in size with an opening toward the north. The stones are not embedded in the surface soils and most have prominent iron oxide staining visible on the upper surfaces. Although no artifacts were noted in proximity to this rock ring, the lack of embedment and the iron oxidation, in conjunction with obvious military vehicle disturbance along the eastern extreme of the site, indicate that the rock feature is of relatively recent military origin.

4-SBr-4736, Flaked Lithic Scatter. This site is located at 3609 feet on a slightly sloping alluvial fan at the northern base of a low hill north of Silver Lake Road. The hill, previously surveyed and recorded (Hanna et al. 1981), was documented and mapped during the current exercise (see previous discussion). A southwest-trending intermittent drainage is sixty meters to the west. The site area has sustained moderate damage from nearby military vehicle tracks and a dirt road which runs through the eastern portion of the site.

Artifacts in the flake scatter include 100+ flakes, two amorphous cores, and one projectile point fragment over an area 25x65 meters (Figure 14). The predominant lithic material is chalcedony, although some chert and obsidian were also observed. The flakes are medium in size and predominantly secondary and

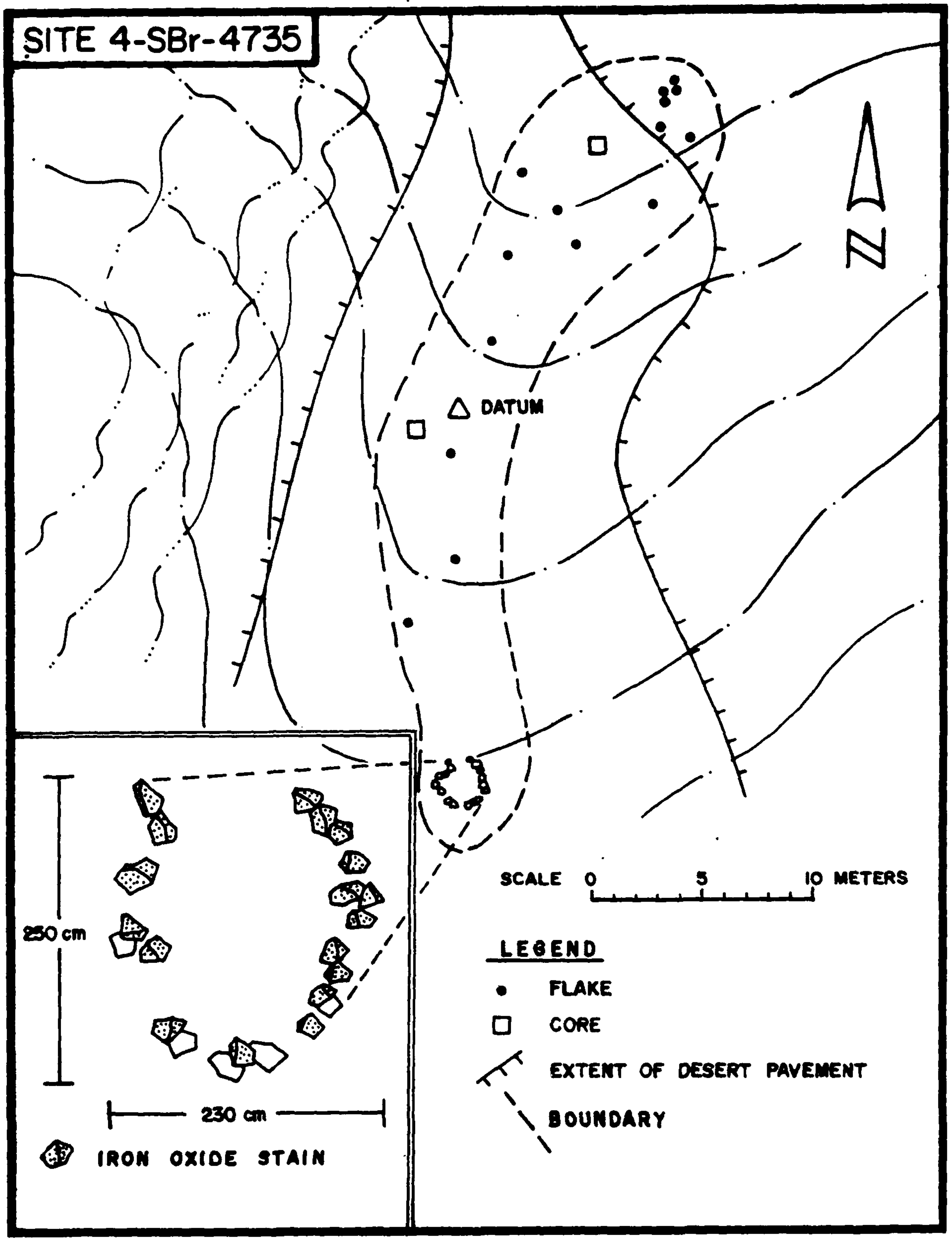


Figure 13

Field sketch of 4-SBr-4735 and enlarged view of probably recent rock ring feature, as described in the text. See Appendix A for specific site location.

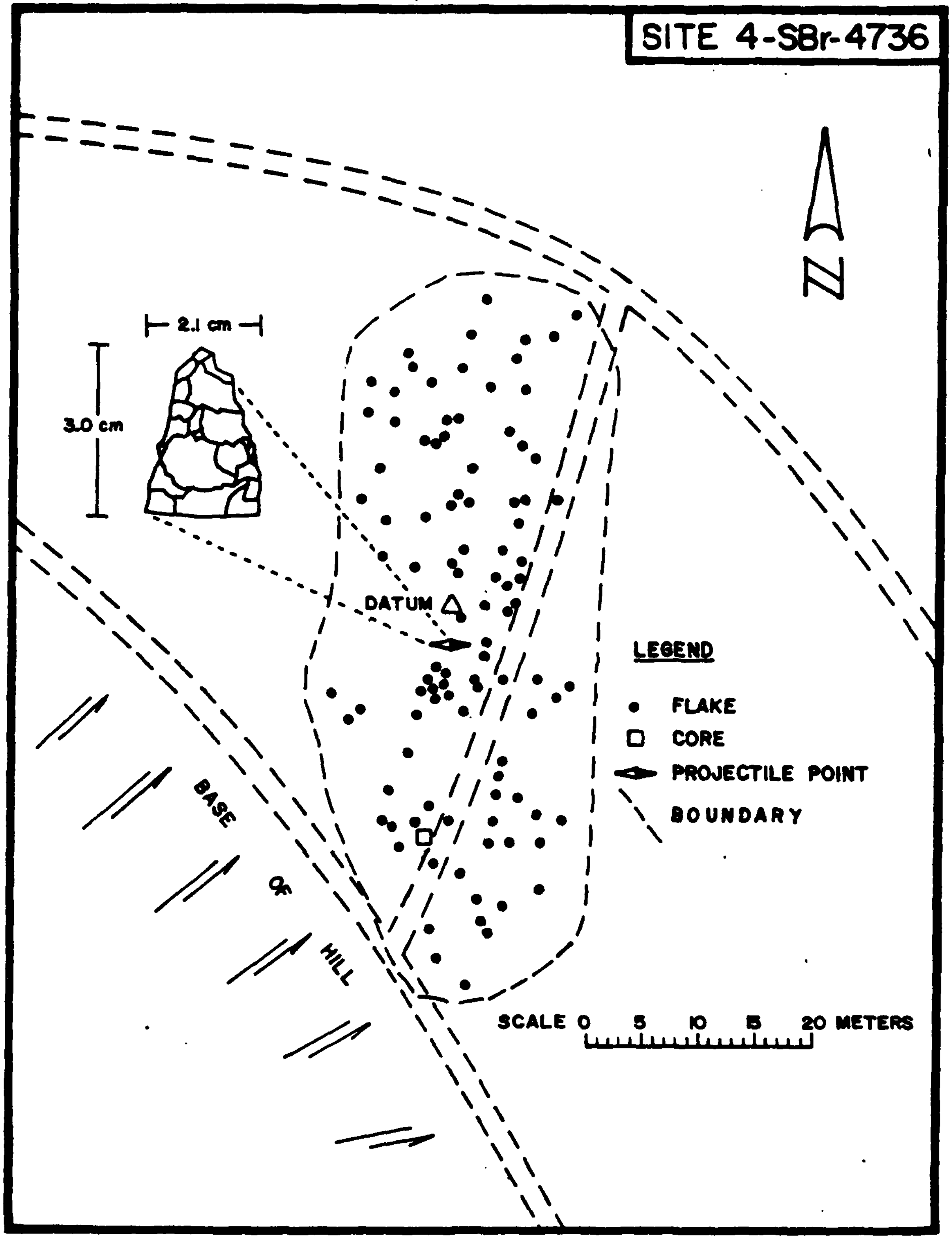


Figure 14

Field sketch of 4-SBr-4736 and projectile point fragment, as described in the text. See Appendix A for specific site location.

many were noted to be partially buried in the loose surface sands of the site. A large chalcedony core, 13x55x40 centimeters in size, was recorded three-fourths buried in the dirt roadway, and approximately twenty flakes were also observed in this roadway. The projectile point tip noted at the site is also of chalcedony and measures three centimeters long and about two centimeters at the broken base. No artifacts were removed from the site.

4-SBr-4741, Rock Cairn. The stacked rock feature is located at an approximate elevation of 3609 feet. It is situated on a sloping aspect of an alluvial fan along the northeastern base of a ridgeline of low hills southwest of Silver Lake Road and is about 250 meters south of the roadway. The cairn is approximately one meter in diameter at its base and eighty-three centimeters high (Figure 15). Approximately fifteen tc twenty granodiorite rocks averaging thirty centimeters in diameter make up the cairn. A search was made of the cairn and immediate area for additional cultural materials, but none were noted. In the absence of prehistoric artifacts, a historic origin is assumed for the cairn.

4-SBr-4742, Flaked Lithic Scatter. This flake scatter was located within an intermittent wash at the southern base of a previously surveyed prominent hill north of Silver Lake Road (see Hanna et al. 1981). Numerous other cultural resources, both sites and isolated finds, have been recorded in the general vicinity. The site was at an approximate elevation of 3480 feet.

In addition to dissecting intermittent drainages throughout the vicinity and probable related erosion, the area has been heavily impacted by military vehicles. Due to this ongoing disturbance, the site materials were plotted in the field and recovered for additional observation in the laboratory. The main site concentration was approximately 15x9 meters, with three outlying artifacts thirty meters to the southeast (Figure 16). As listed in Table 7, the recovered artifacts include seven debitage, three secondary and four primary flakes, one utilized flake (see Figure 16), and one multidirectional core with 40 percent remaining cortex. The lithic material of all the artifacts is chalcedony.

4-SBr-4743, Flaked Lithic Scatter. This flake scatter was situated at 2608 feet in elevation within a disturbed desert pavement along the northeast side of a dissected alluvial terrace. It was approximately 250 meters east of the Silver Lake Road extension in general proximity to several other cultural resource sites and isolated finds. Bow Willow Wash is about 500 meters west of the site.

Numerous military tank and vehicle tracks have severely impacted the site area; as these impacts are likely to be ongoing, the artifactual materials were plotted and collected during the

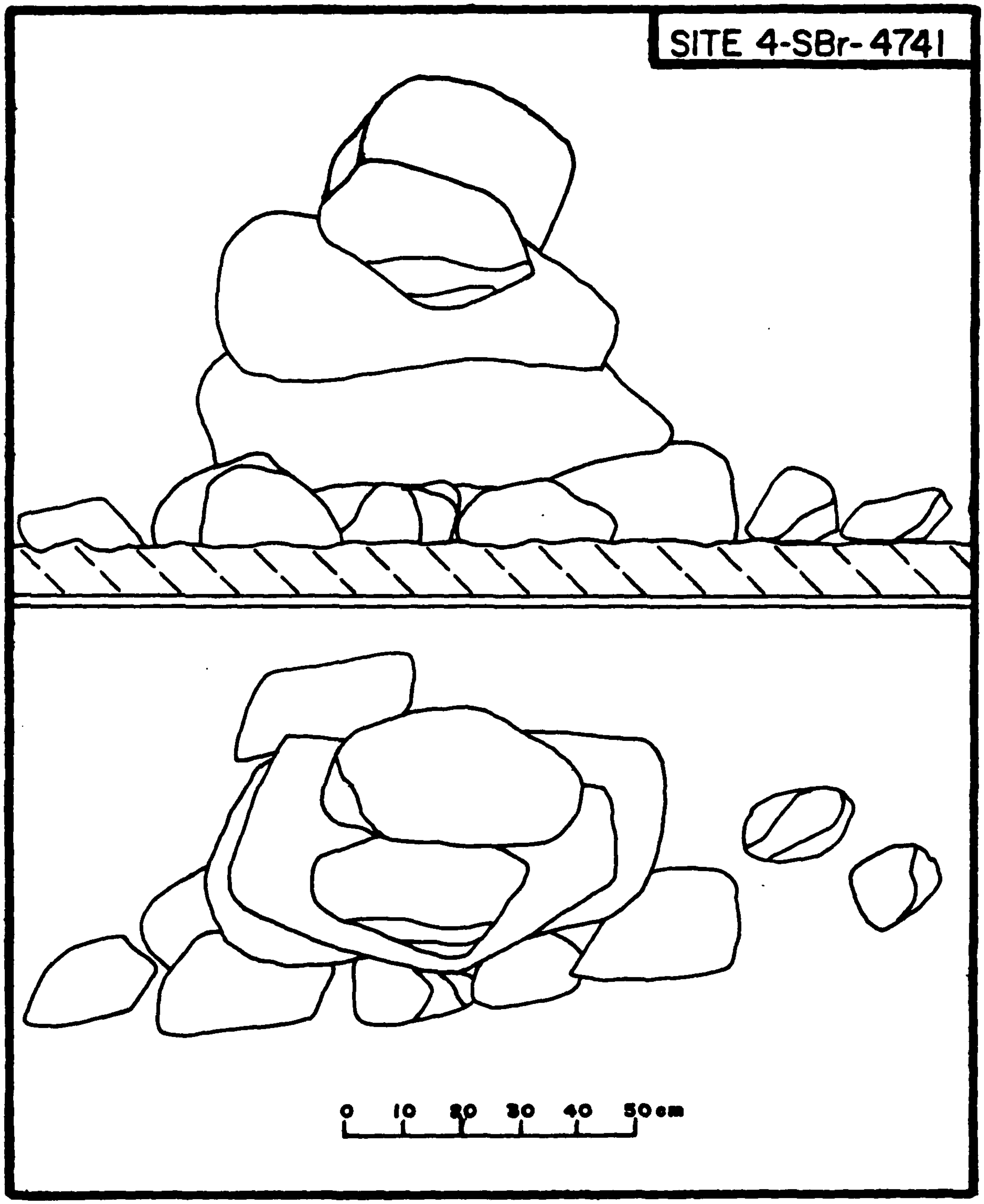


Figure 15

Field sketch of the general configuration of 4-SBr-4741, a stacked rock cairn. The upper portion of the drawing represents a profile view of the feature facing southwest; the lower portion presents a plan view of the cairn. See Appendix A for specific site location.

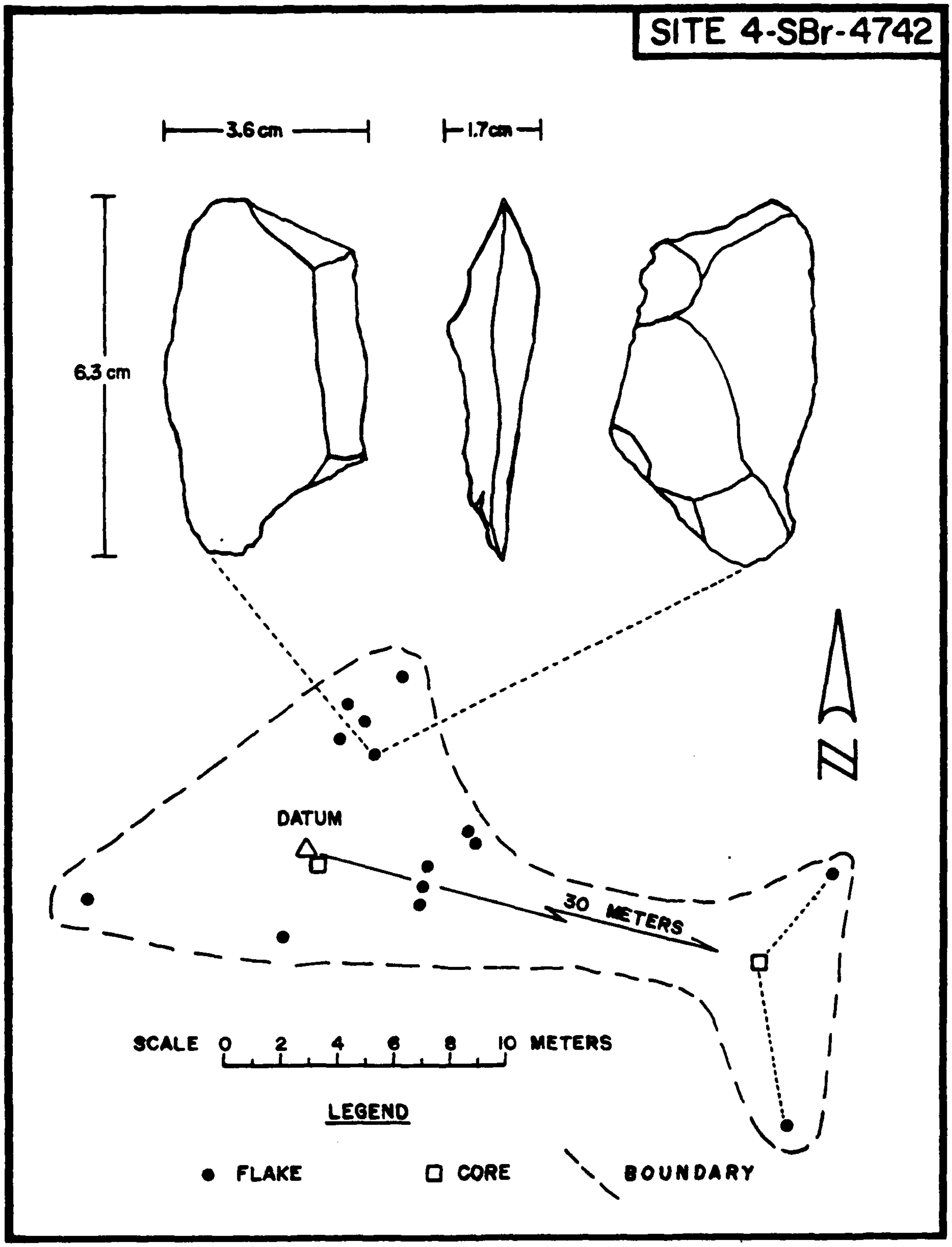


Figure 16

Field sketch of 4-SBr-4742 and a utilized flake, as described in the text. See Appendix A for specific site location.

Table 7
RECOVERED ARTIFACTS - 4-SBr-4742

Catalog Number	Length (cm)	Width (cm)	Thickness (cm)	Weight (gm)	Quantity	Provisional Artifact Type
4-SBr-4742-1-062	--	--	--	104.0	7	Debitage
4-SBr-4742-1-063	6.2	3.5	1.27	28.2	1	Utilized flake
4-SBr-4742-1-064	6.09	4.73	1.85	48.8	1	Secondary flake
4-SBr-4742-1-065	2.4	4.2	0.8	9.0	1	Primary flake
4-SBr-4742-1-066	4.2	2.0	7.0	7.0	1	Secondary flake
4-SBr-4742-1-067	5.1	5.3	1.6	29.8	1	Primary flake
4-SBr-4742-1-068	3.6	3.0	0.9	7.6	1	Primary flake
4-SBr-4742-1-069	1.8	2.1	0.7	2.4	1	Secondary flake
4-SBr-4742-1-070	2.0	3.1	0.6	3.6	1	Primary flake
4-SBr-4742-1-071	9.9	8.1	3.4	247.8	1	Multidirectional core

Table 8
RECOVERED ARTIFACTS - 4-SBr-4743

Catalog Number	Length (cm)	Width (cm)	Thickness (cm)	Weight (gm)	Quantity	Provisional Artifact Type
4-SBr-4743-1-100	7.8	6.4	3.9	288.6	1	Multidirectional core
4-SBr-4743-1-101	5.0	4.1	2.0	37.2	1	Secondary flake
4-SBr-4743-1-102	3.1	2.6	0.9	9.2	1	Primary flake
4-SBr-4743-1-103	5.1	3.6	1.1	18.2	1	Primary flake
4-SBr-4743-1-104	5.1	5.2	1.3	31.8	1	Secondary flake
4-SBr-4743-1-105	4.9	4.5	1.4	24.6	1	Primary flake
4-SBr-4743-1-106	5.5	5.0	1.6	48.8	1	Secondary flake
4-SBr-4743-1-107	5.1	5.0	0.7	25.0	1	Secondary flake
4-SBr-4743-1-108	4.7	3.3	0.7	8.0	1	Secondary flake
4-SBr-4743-1-109	2.3	2.4	1.0	5.0	1	Secondary flake
4-SBr-4743-1-110	2.3	4.3	8.5	9.6	1	Secondary flake
4-SBr-4743-1-111	6.4	3.5	1.1	26.0	1	Secondary flake
4-SBr-4743-1-112	3.3	3.4	0.8	9.4	1	Primary flake
4-SBr-4743-1-113	4.7	8.8	2.0	62.6	1	Primary flake
4-SBr-4743-1-114	2.5	4.5	0.7	10.0	1	Secondary flake
4-SBr-4743-1-115	3.8	4.1	1.7	23.8	1	Secondary flake
4-SBr-4743-1-116	2.3	2.9	0.8	7.8	1	Secondary flake
4-SBr-4743-1-117	5.4	2.9	0.9	4.6	1	Primary flake
4-SBr-4743-1-117	3.5	2.9	0.67	6.0	1	Primary flake
4-SBr-4743-1-117	4.5	3.0	1.2	6.4	1	Secondary flake
4-SBr-4743-1-117	4.2	2.4	0.7	6.0	1	Secondary flake
4-SBr-4743-1-117	3.6	4.9	1.5	3.6	1	Primary flake
4-SBr-4743-1-117	2.9	4.7	1.6	6.7	1	Primary flake
4-SBr-4743-1-117	3.7	2.4	0.7	6.5	1	Secondary flake
4-SBr-4743-1-117	4.9	5.2	1.8	33.0	1	Secondary flake
4-SBr-4743-1-117	6.8	4.7	4.1	113.5	1	Core-based tool
4-SBr-4743-1-117	--	--	--	--	24	Debitage

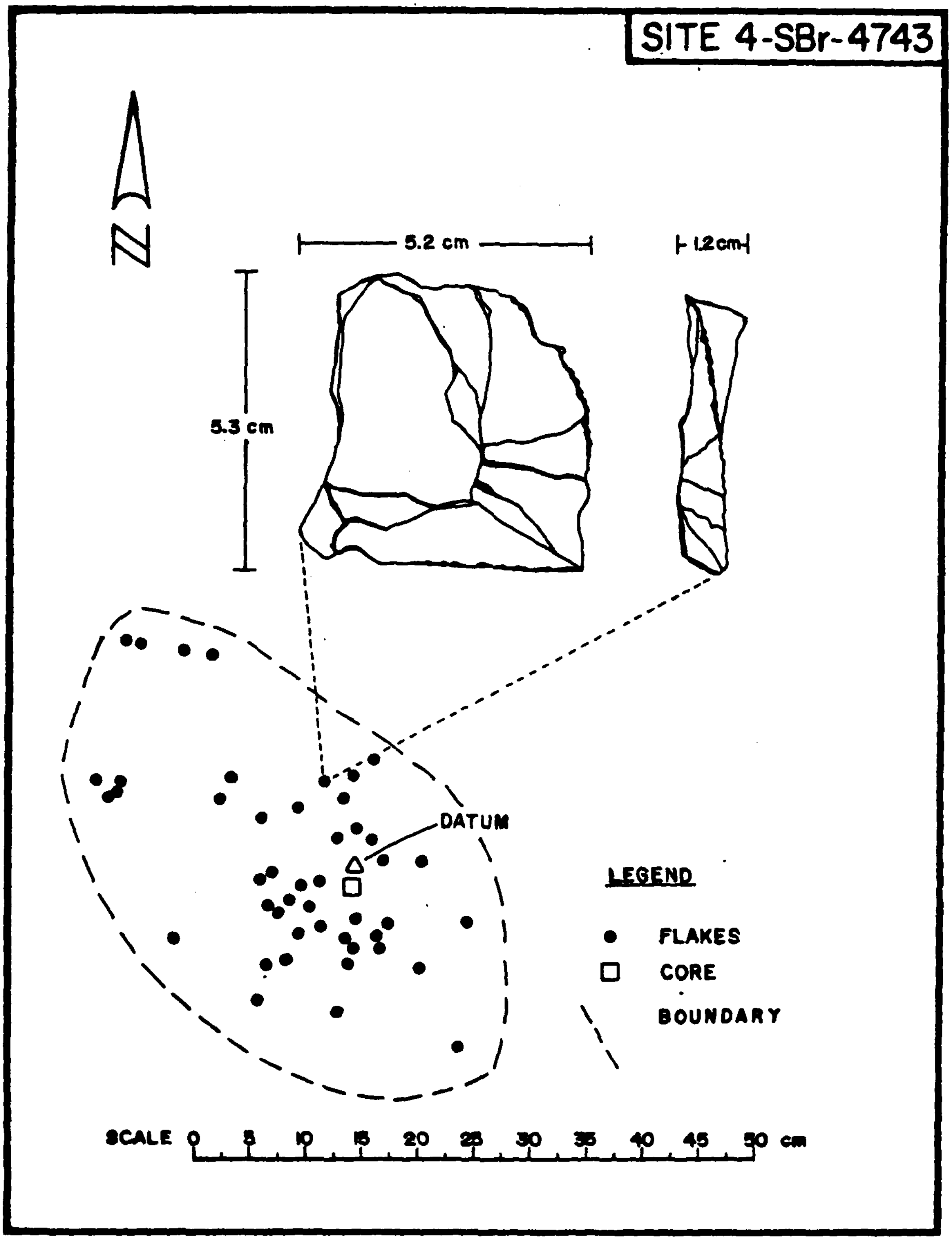


Figure 17

Field sketch of 4-SBr-4743 and a possibly utilized flake, as described in the text. See Appendix A for specific site location.

field reconnaissance. The site area was approximately 50x35 meters in size (Figure 17). Table 8 lists the recovered artifacts, which include twenty-four debitage, fifteen secondary flakes, nine primary flakes, one multidirectional core, and one core-based tool. The artifacts are of two grades of chalcedony--a mottled brown chalcedony and a whiter, clearer agate-like chalcedony. Most of the artifacts are slightly to moderately patinated with very small traces of iron oxide staining. The flakes and debitage are both primary and secondary. When located in the field, some fifteen of the flakes were on the surface of the pavement and the remaining flakes and the core were semi-embedded. The multidirectional core has about 70 percent cortex remaining on its outer surface. The core-based tool is planate in form with slight evidence of utilization along one edge. Laboratory analysis has revealed that some of the flakes are reconstructible onto the core.

4-SBr-4744, Flake Scatter. The site is located about 200 meters south of Silver Lake Road on a relatively flat portion of the alluvial fan along the northeastern base of a ridgeline of low hills. A small intermittent drainage occurs north of the site. Elevation is approximately 3609 feet. Military ordnance fragments in the area and a military vehicle track twenty meters north were noted.

The site encompasses an irregularly shaped area about 36x36 meters. At least thirty chalcedony flakes, including one retouched flake, were observed (Figure 18). No cores or other artifactual materials were located in association. None of the flakes were removed from the field during the survey reconnaissance.

4-SBr-4745, Core Reduction Station. The site is situated on the southwest slope of a dissected alluvial terrace about 100 meters east of the Silver Lake Road extension. Elevation of the site is approximately 2685 feet. Intermittent drainages are evident throughout the general vicinity, with Bow Willow Wash 250 meters to the west. As with nearby cultural resources, this site has been disturbed by military tanks and vehicles. In addition, the site materials appear to be eroding downhill as many of the flakes were located along the terrace slope while the cores are still in place on the top of the terrace.

As depicted in Figure 19, the site area is about 31x10 meters and includes fifty-four-plus flakes, five cores, and a utilized flake or burin. All of the artifacts are of a jasper lithic material. Over half of the flakes were noted to have visible cortex, and most of the artifacts were partially embedded in the surface soils.

The utilized flake or burin-like tool was collected from the field (4-SBr-4745-1-118) and is drawn on Figure 19. Utilization

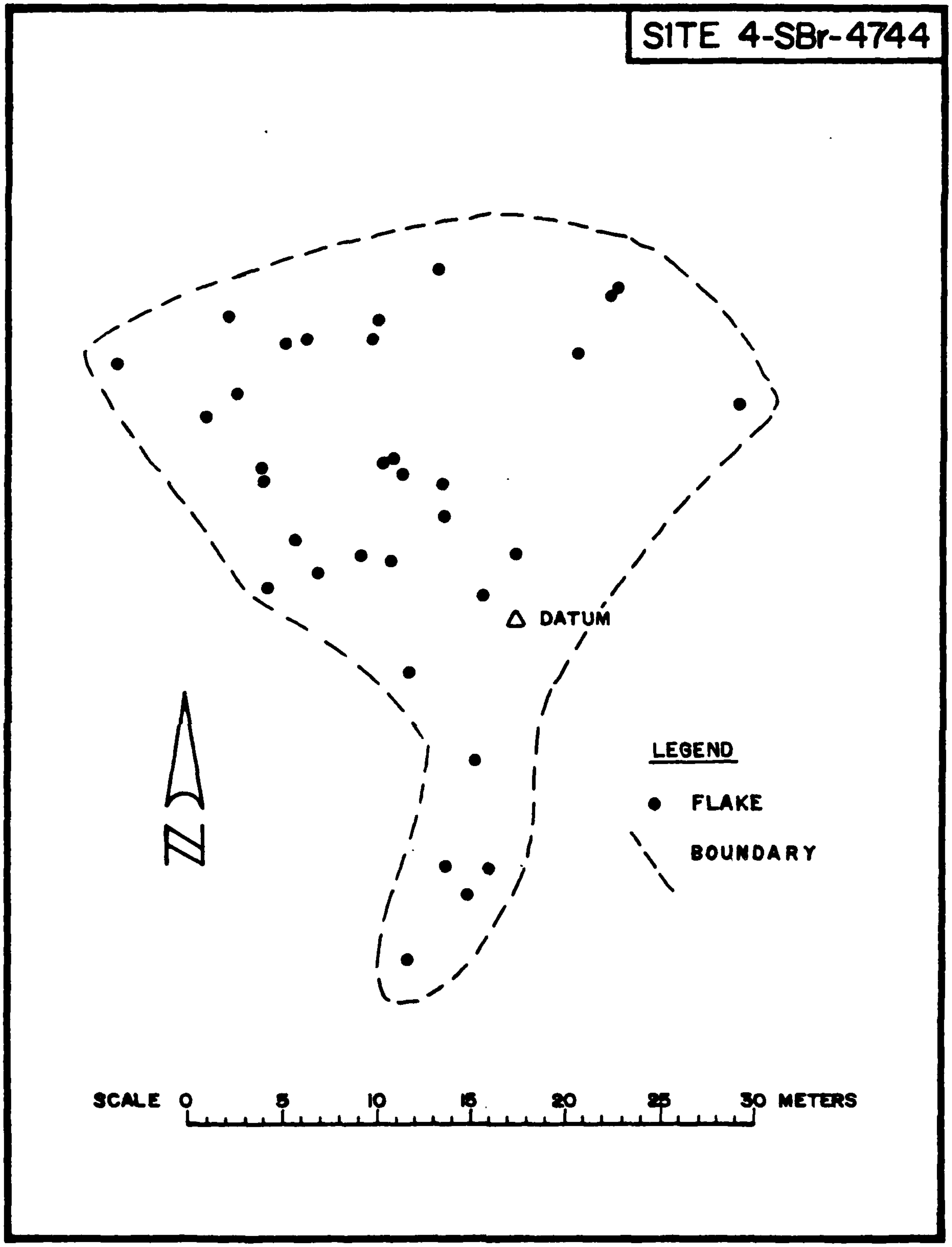


Figure 18

Field sketch of 4-SBr-4744, as described in the text. See Appendix A for specific site location.

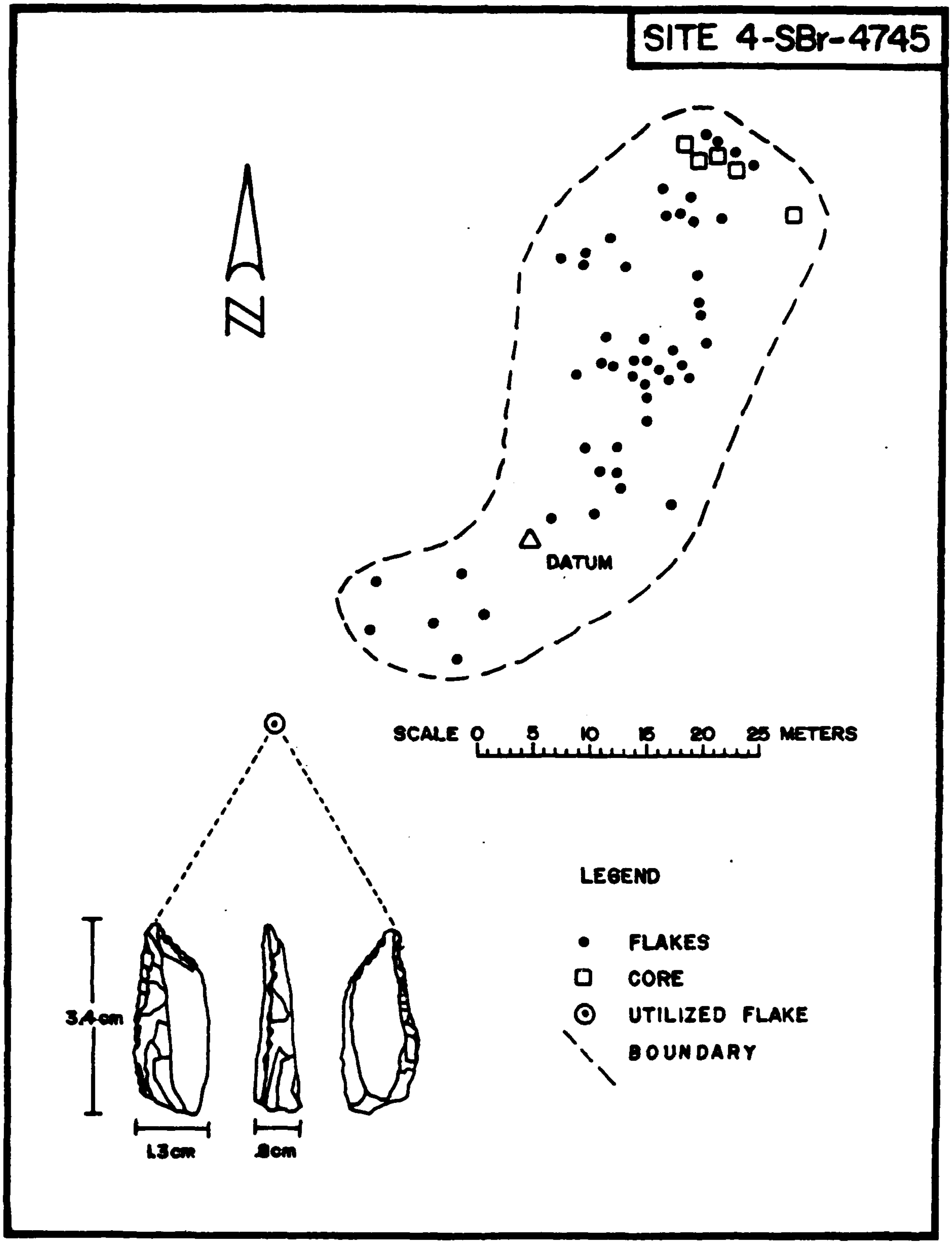


Figure 19

Field sketch of 4-SBr-4745 and a burin-like tool collected from the site, as described in the text. See Appendix A for specific site location.

is evident along several edges, including the tip or point. The tool weighs 3.4 grams.

4-SBr-4746, Flaked Lithic Site Complex. The largest site complex recorded during the survey reconnaissance is SBr-4746, located at an elevation of approximately 2590 feet on a heavily disturbed desert pavement along the cut bank overlooking Bow Willow Wash. The site is in the southern-most portion of the survey zone, about 150 meters west of the Silver Lake Road extension and just east of Bow Willow Wash. Additional cultural resource sites and isolated finds were recorded in this area during the current study and may be associated with this larger site complex.

Numerous loci or concentrations of artifactual materials were observed and recorded during the field investigation, including core reduction areas, lithic scatters, groundstone tools, and isolated scattered artifacts over an area 200x75 meters in size (Figure 20). Artifacts recorded within this overall area include approximately 450+ flakes, 25+ cores, numerous bifaces, several utilized flakes, scrapers and bifacially flaked tools, a flake-based chopping tool, four metates, and two manos. The predominant lithic material is chalcedony, although quartzite, basalt, andesite, and felsite artifacts were also noted. The artifacts within this site have been disturbed to some degree by erosion, vehicle maneuvers, and the development of Silver Lake Road. Slight patination and iron oxidation was noted on many of the artifacts, and site materials vary from partially embedded to resting on the surface of the supporting desert pavement. More detailed description of the various artifacts and concentrations observed within this site is presented below.

In the northern portion of the site are several clusters of primary and secondary chalcedony flakes (five and six flakes, respectively), with isolated outlying flakes in proximity. To the southwest is another concentration of artifacts, including a felsite flake-based hammerstone/pounder, one bifacially flaked scraper, and five primary felsite flakes. Within an area of several converging vehicle tracks a flake scatter of over thirteen primary chalcedony flakes was reported, and to the east is another concentration containing amorphous and multidirectional cores, several bifaces, a modified flake, and over thirty primary flakes. Most of these artifacts are chalcedony, although one felsite flake was noted; a stage 2 biface measuring 7.5x7x3.5 centimeters with 40 percent cortex was also recorded and drawn.

Adjacent to the south is an area containing several concentrations of artifacts and associated isolated cultural materials. Along the western portion of the site are core reduction stations containing over fifty primary and secondary flakes--both chalcedony and quartzite--chalcedony cores, a quartzite hammerstone, and a utilized flake. To the east are several vehicle tracks and additional flake scatters, a utilized flake, and a stage 1 biface

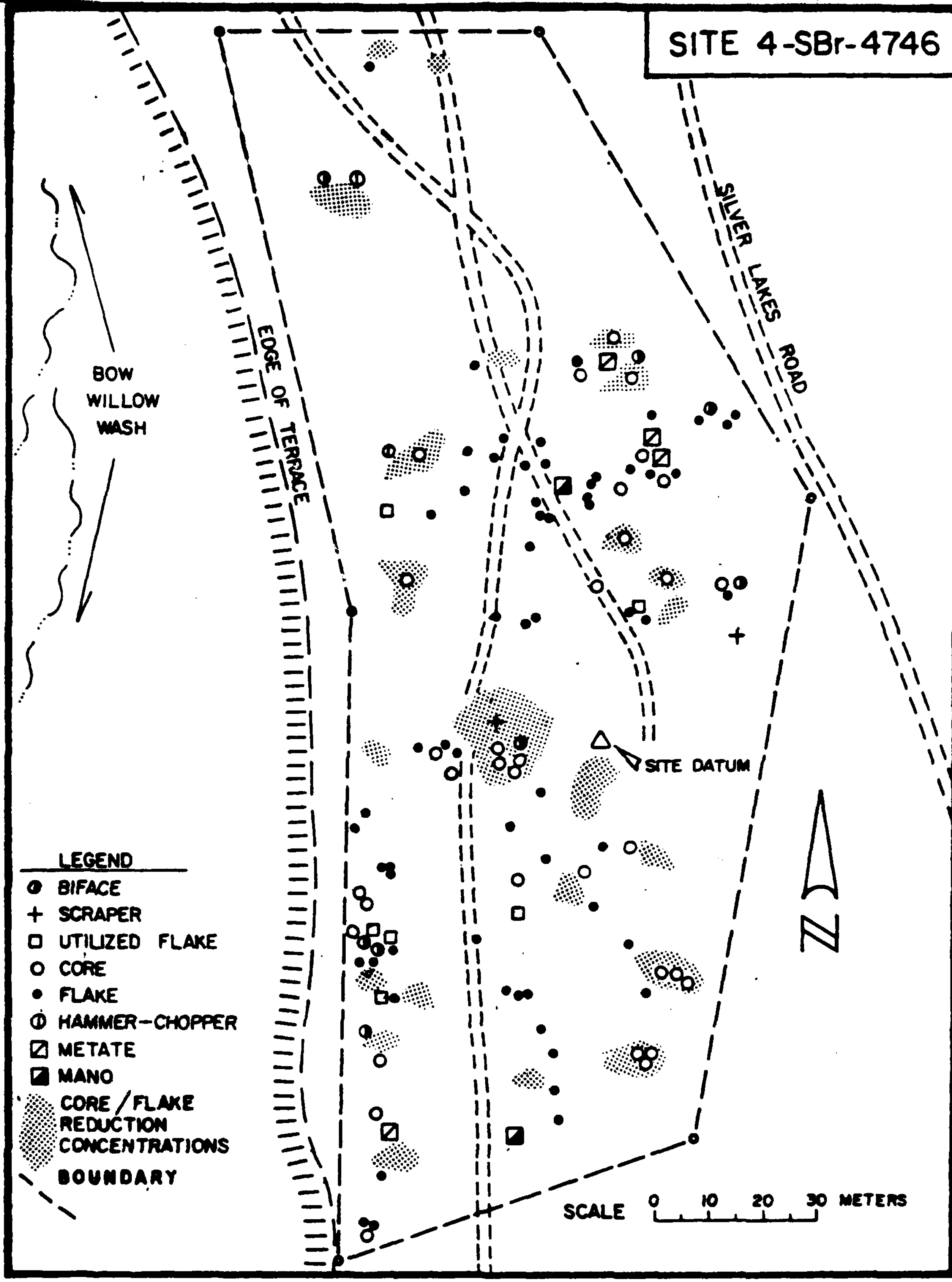


Figure 20

Field sketch of 4-SBr-4746, as described in the text. See Appendix A for specific site location.

measuring 4.5x3.5 centimeters. South of these lies a larger lithic scatter of over twenty-five chalcedony primary flakes, two bifacially flaked chalcedony tools, one chalcedony core, and one basalt flake. A light scattering of flakes continues southward to a flaked lithic concentration of over ninety chalcedony primary flakes, two scrapers, and one bifacial tool. The biface has no cortex and is seven centimeters long; a scraper-like tool, planate in form and measuring 7x3 centimeters, was also noted. Just south of the site datum (see Figure 20) are several core reduction stations with over 120 primary chalcedony flakes, nine cores, and a unifacial tool. One of the cores is a felsite, multidirectional, tabular core measuring 17.5x14.5x3 centimeters. The unifacial tool is scraper-like, 4x3.5x1.2 centimeters, no cortex, and has evidence of use along one edge.

In the southern and western portion of the site are several flake scatters of andesite and chalcedony--including over ten modified flakes--and a high concentration of cores and bifacial tools of chalcedony, felsite, and basalt. A typological blade and a stage 2 biface were specifically noted in this area. The southwestern portion of the site contains a flake scatter of twelve chalcedony primary flakes and another core reduction station consisting of over twenty-two chalcedony primary flakes and three cores.

As illustrated in Figure 20, various types of groundstone also occur throughout the site. Slab metates--whole and fragmented--were recorded with unifacial and bifacial grinding evidence. The two recorded manos are a shouldered fragment and a bifacially utilized mano.

4-SBr-4747, Rock Cairn. The rock feature is located on a moderately developed desert pavement about 350 meters south of Range 24 along Silver Lake Road. The area is a slightly sloping alluvial fan at an approximate elevation of 3346 feet. A southwest-trending intermittent drainage occurs 75 meters to the southeast.

The feature is a deflated rock cairn composed of some thirty medium-size granodiorite stones, about 1x1 meter in size (Figure 21). Many of the stone elements are well embedded in the surrounding pavement, although several have visible iron oxidation on the uppersides of the stones, indicating probable disturbance to the feature at one time. As with the other cairns recorded during this investigation, no prehistoric artifacts were noted in the vicinity of the cairn.

4-SBr-4748, Rock Cairn. This stacked rock feature is situated on a portion of a gently sloping alluvial fan approximately 440 meters north of Silver Lake Road and 1.25 kilometers northeast of the intersection of Silver Lake Road with the dirt road to Cave Springs. A north-trending intermittent drainage occurs

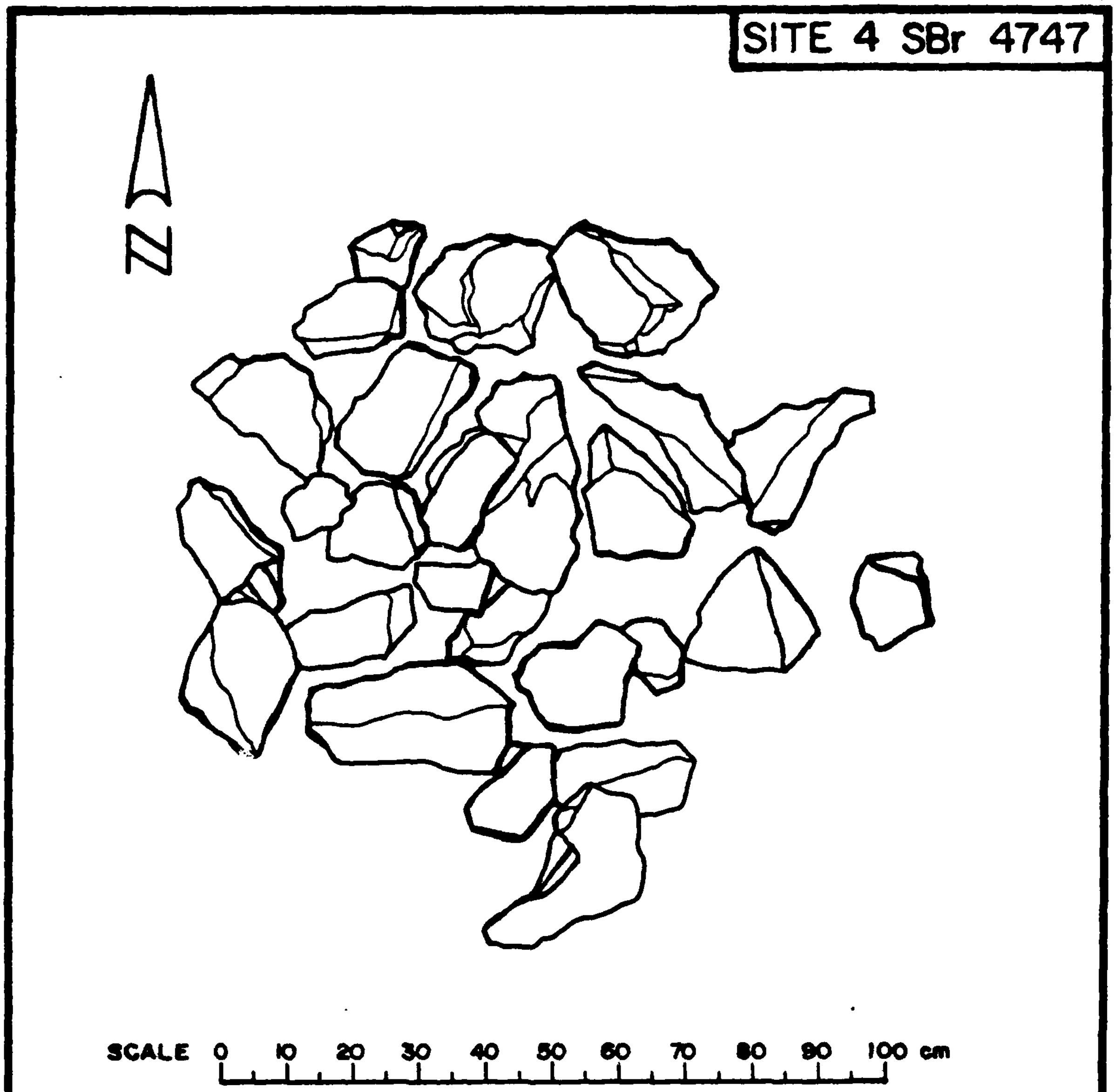


Figure 21

Field sketch of 4-SBr-4747, as described in the text. See Appendix A for specific site location.

twenty meters to the west. A few military tank tracks are present in the general vicinity of the feature.

As currently observed, the cairn has two aspects--a stacked portion and an associated deflated portion (Figure 22). The stacked rock feature is composed of six medium- and large-size boulders with overall dimensions of 59x52 centimeters at the base and a height of sixty centimeters. At the northeast base of the stacked feature is an additional grouping of twelve stones which appear to have once been an aspect of the stacked cairn. The entire area of the cairn--stacked and deflated--is 1.8x1.6 meters. With the absence of any prehistoric artifacts in association with this cairn, a historic origin is assumed for the feature.

4-SBr-4749, Lithic Reduction Station. The site is located on a moderately developed desert pavement which is on a portion of a dissected alluvial fan between two north-trending intermittent drainages. The area is at an approximate elevation of 3530 feet at the base of a previously surveyed low hill north of Silver Lake Road. Several sites and isolated finds of similar cultural materials have been recorded nearby.

Site materials consist of thirty to forty medium-size, highly patinated chalcedony flakes over an area 3x1.5 meters (Figure 23). Most are embedded in the desert pavement and have substantial amounts of cortex remaining on the flake. No core or other artifactual materials are associated with this site. None of the flakes were removed from the site.

4-SBr-4750, Core Reduction Station. This site is situated at 3018 feet on a dissected terrace foot 100 meters south of the High Pass Road and about 2.9 kilometers west of the Silver Lake Road extension. A southeast-trending intermittent drainage occurs 115 meters to the north, and recorded isolated finds were noted in the immediate vicinity. Military ordnance fragments are present east, southwest, and northeast of the site.

Approximate counts of artifacts at the site are ten flakes, six cores, one bifacially flaked tool fragment, and one scraper-type tool fragment over an area 3x5 meters (Figure 24). Two varieties of lithic material are represented, a translucent brown chalcedony and a purplish chalcedony. About 85 percent of the artifacts are on the surface and the remainder are partially embedded.

The bifacial tool fragment was recovered from the field for further analysis. It measures 5.83x3.31x1.94 centimeters and weighs 39.4 grams (see Figure 24). The surface of the tool is moderately patinated and a small amount of cortex remains, but there is no visible evidence of use damage.

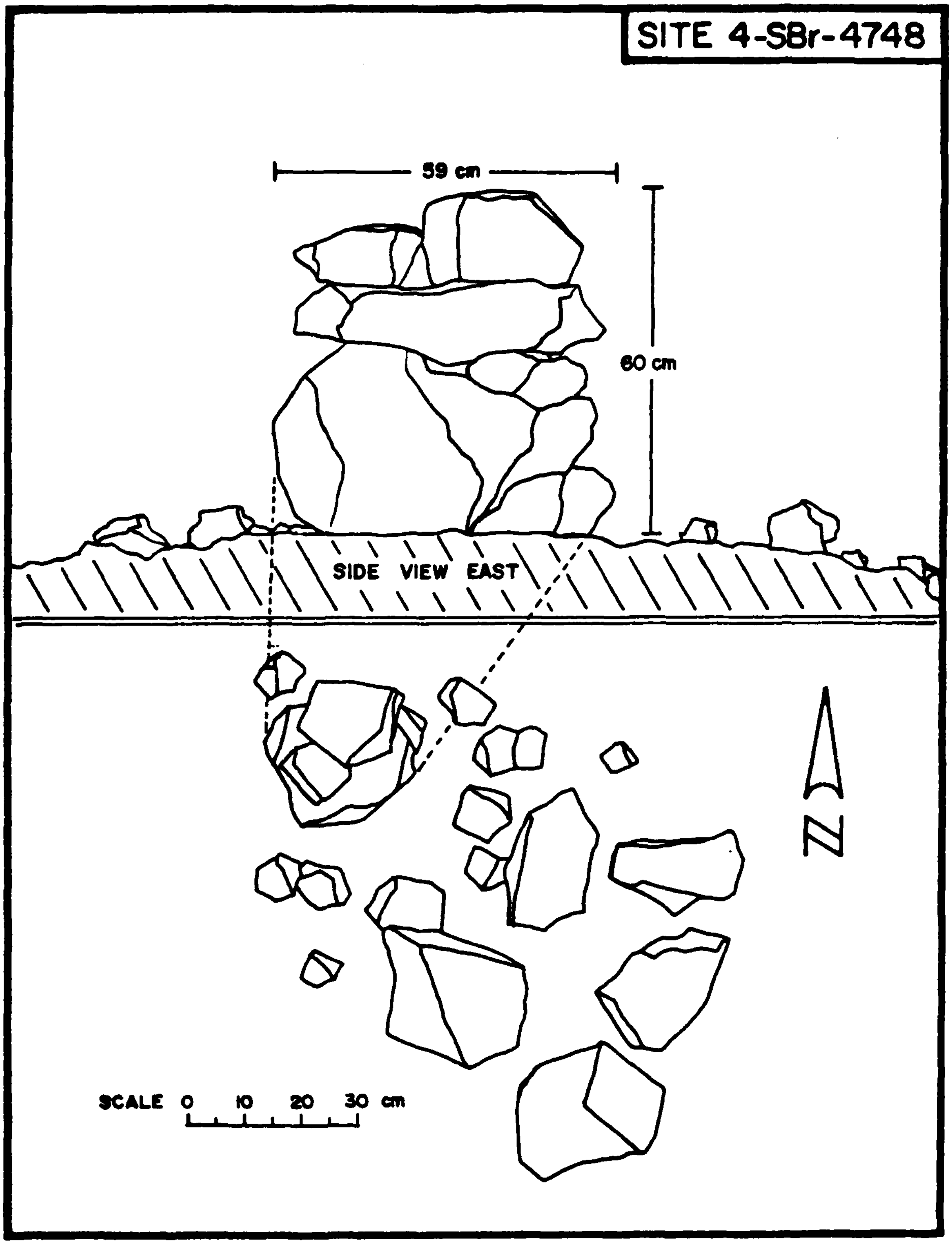


Figure 22

Field sketch of two views showing stacked and deflated portions of 4-SBr-4748, as described in the text. See Appendix A for specific site location.

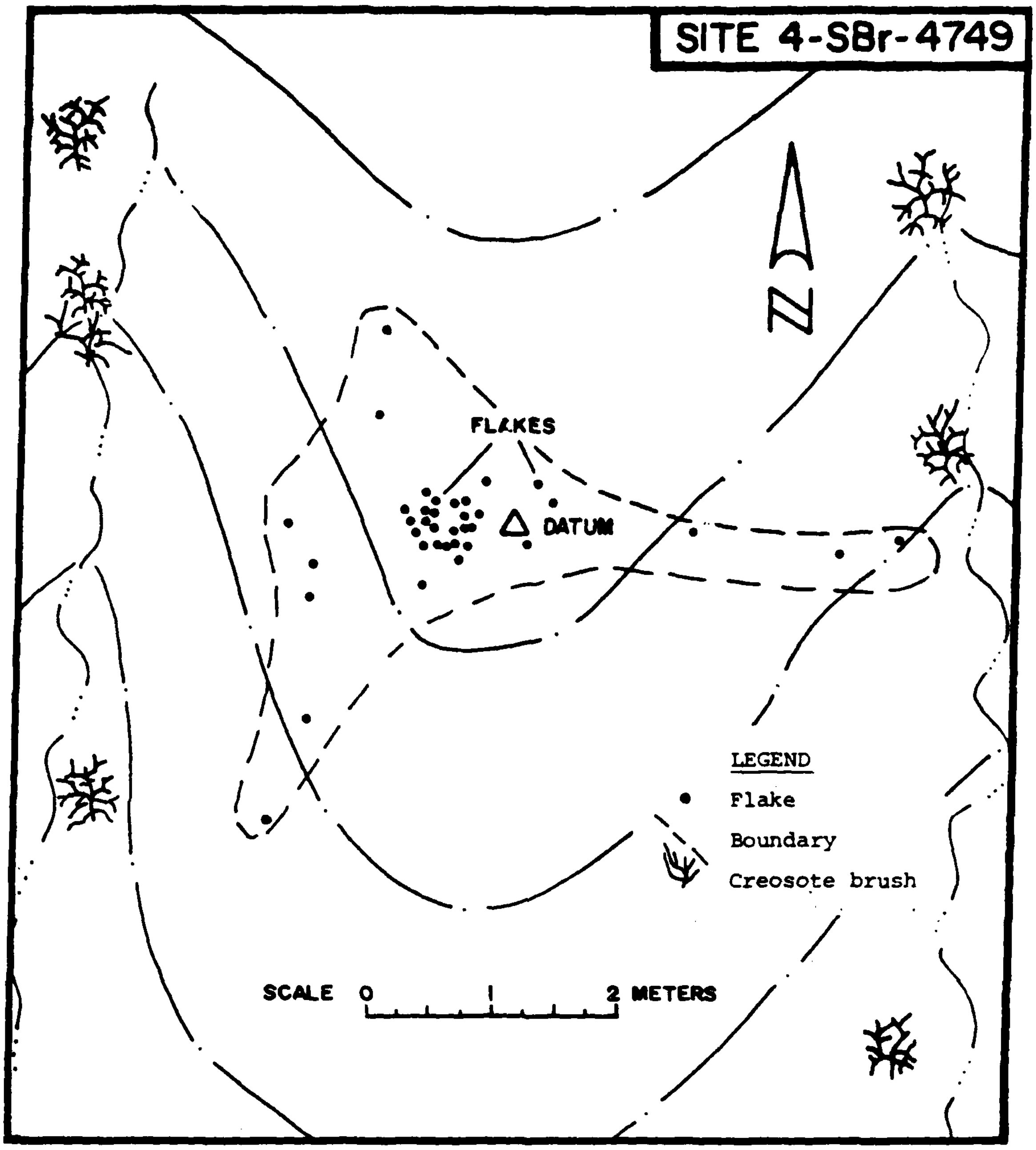


Figure 23

Field sketch of 4-SBr-4749, as described in the text. See Appendix A for specific site location.

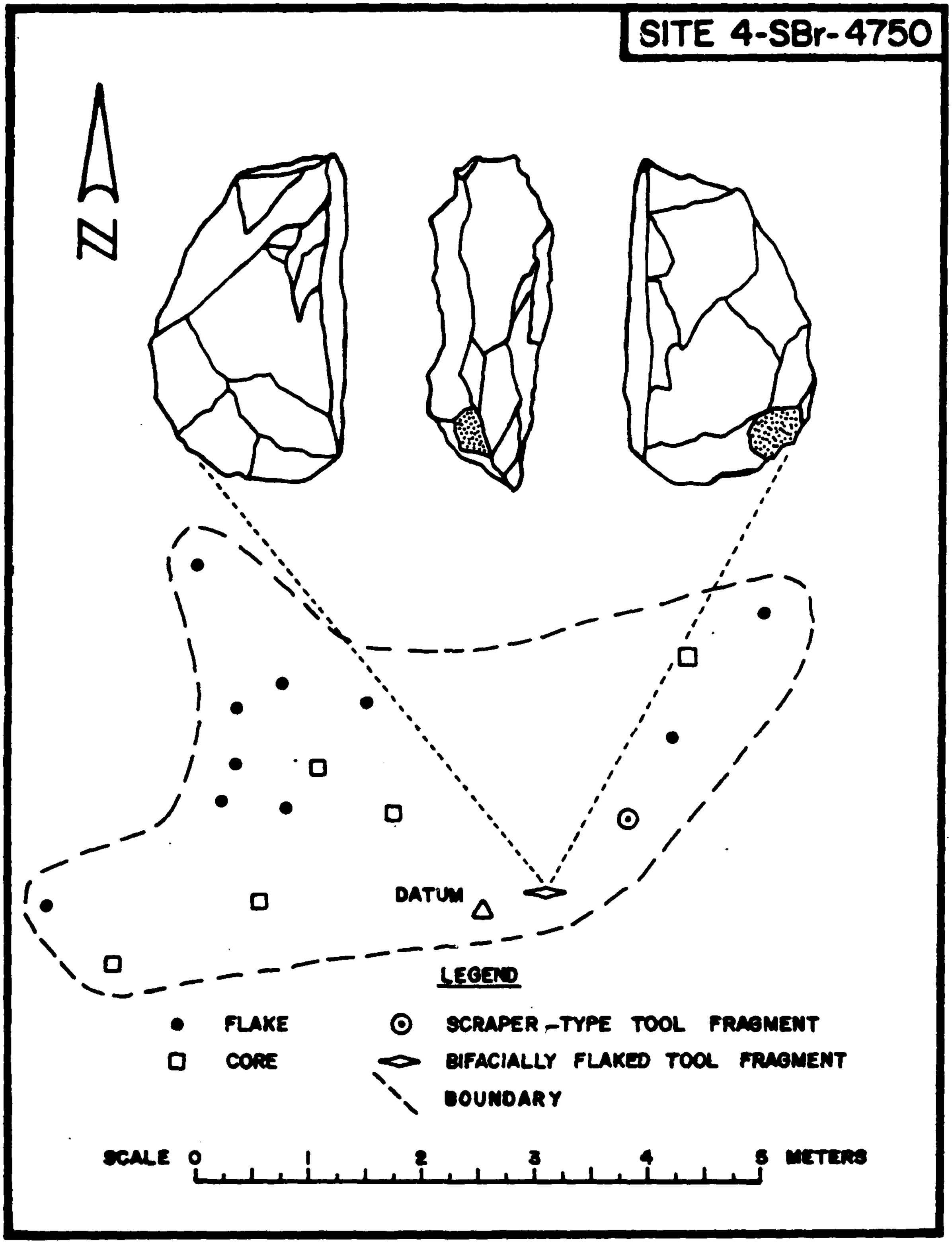


Figure 24

Field sketch of 4-SBr-4750 and bifacial tool fragment recovered from the field, as described in the text. See Appendix A for specific site location.

4-SBr-4751, Rock Ring Feature. This feature is situated at an elevation of 3051 feet on a desert pavement 650 meters south of Bow Willow Wash. The Silver Lake Road extension is about 2.05 kilometers west and the High Pass Road is 32 meters south. North/northwest-trending drainages occur 20 meters north of the site. Several isolated finds were also recorded in the area of this feature. Military tank tracks occur just north of the site, and erosional disturbance is also evident north of and adjacent to the feature.

Figure 25 illustrates the feature at this site, which is a three-meter-diameter rock ring composed of basalt clasts greater than fifteen centimeters in size. The central portion of the circle has been cleared. Two other possible rock ring configurations were observed northeast of this site, but due to the light conditions and disturbance of the site, a definite determination was not possible during the current reconnaissance. Although no additional cultural materials were noted in association with this rock ring, one utilized chalcedony flake was observed twenty-six meters north.

4-SBr-4752, Flaked Lithic Loci. This site complex is situated on a well-developed, disturbed desert pavement along the edge of a cut bank overlooking Bow Willow Wash to the west. The Silver Lake Road extension is seventy-five meters to the west and elevation at the site is approximately 2690 feet. Several isolated finds and sites were recorded in the vicinity of this site. Disturbance to the site area is primarily evident from military vehicle tracks, especially to the east.

As seen in Figure 26, SBr-4752 is composed of three artifactual concentrations or loci within an area 53x7 meters in size. Locus A measures about 13x7.5 meters and contains one ovate biface with 50 percent cortex remaining, one unifacial felsite scraper, and approximately thirty flakes and debitage. About half of the flakes and the two tools are embedded in the pavement surface; the remainder are located on the surface. Locus B, 6x5 meters in area, is about thirty-five meters south of Locus A and includes over twenty flakes/debitage, most of which are not embedded in the pavement. Locus C is a small flake scatter twelve meters south of Locus A. It consists of over eight flakes or debitage, three of which are embedded in the pavement surface. With the exception of one basalt flake in Locus B and the felsite scraper in Locus A, all of the artifacts are of chalcedony. An isolated chalcedony core was also recorded twenty meters south of Locus B.

MAPPING, DOCUMENTATION, AND RECORDING

An important aspect of the current project was in-field recording of specific activity loci within previously located

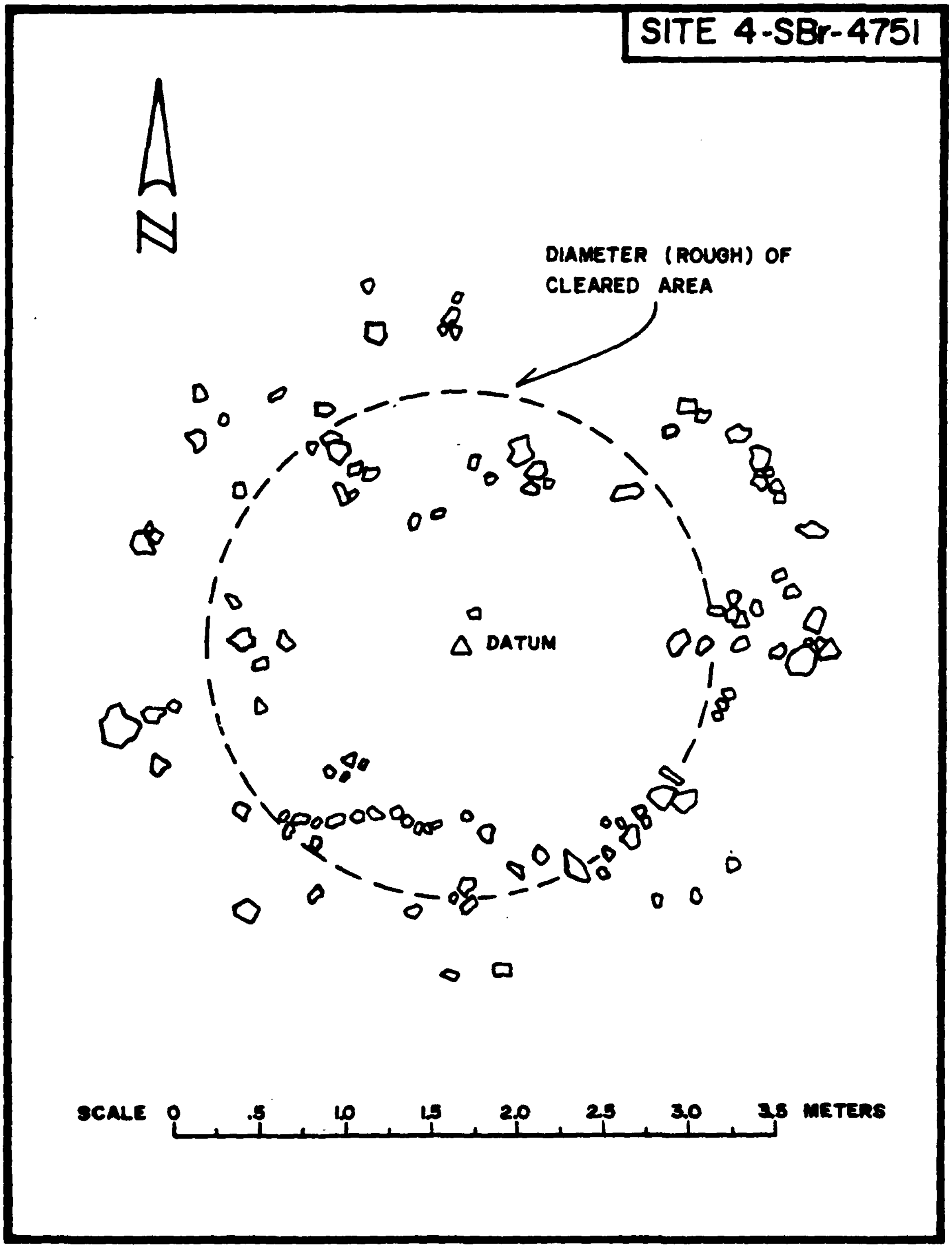


Figure 25

Field sketch of 4-SBr-4751, as described in the text. See Appendix A for specific site location.

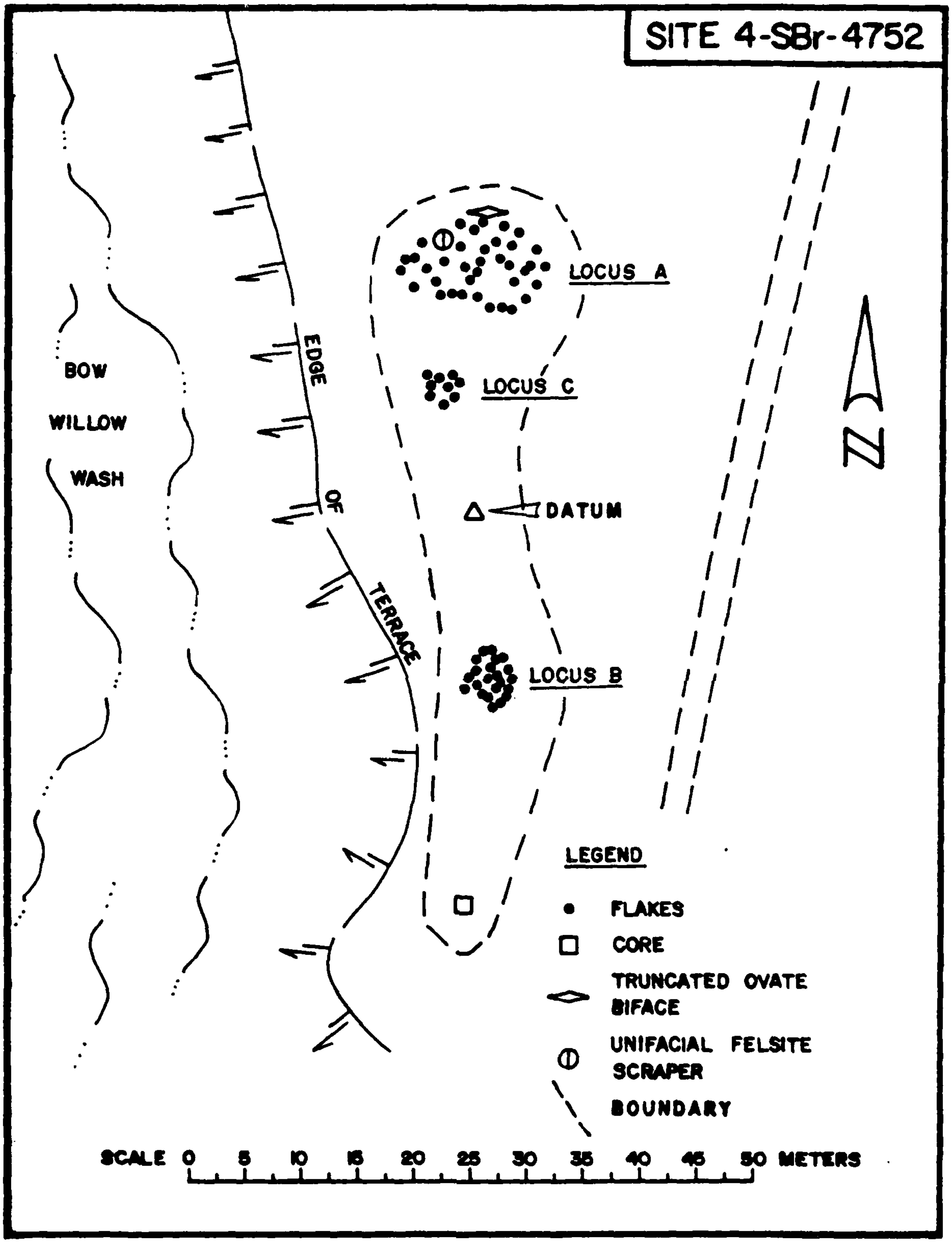


Figure 26

Field sketch of 4-SBr-4752, as described in the text. See Appendix A for specific site location.

cultural deposits in the Assembly and Bow Willow Wash areas (sites SBr-4249 and -4204) and two areas along Silver Lake Road (sites SBr-4515 and -4516). The goal was to further document the activity loci and features within these areas, thereby providing more detailed definition as to site types represented, extent of site materials, cultural and chronological associations, resource variability and extent, and potential for the resources to add to an understanding of the region's prehistory.

A general review of plat maps B-N (Appendix A) shows wide diversity in the distributions and frequencies of various forms of flaked lithic tools and features. Site boundaries clearly identified on these maps are actually more nebulous than portrayed. Areas where outlying symbols are shown reflect the potential for a continuation of artifactual debris outside the heavy concentrations subjected to current study (cf. Maps B, C, H, I and K, Appendix A). The map symbols represent the "predominant" occurrences within the numerous widely distributed localities; detailed examination of each locus would undoubtedly present considerable amounts of other significant data for systematic recovery considerations.

Residues of past aboriginal occupation within the study zones range from isolated specimens and features to very complex and intense concentrations of multiple-activity debris. For discussion purposes, the entire mapping project was subdivided into three distinct research zones: Bow Willow Wash area (Maps F-J, Appendix A), Assembly Area (Maps K-N, Appendix A), and Silver Lake Road area (Maps B-E, Appendix A). This was done to allow general comparison and evaluation of varying subregional activity emphases. Tables 9 and 10 have been formulated to illustrate absolute and relative frequencies within and among the three research zones (discussion of the various artifact and feature forms is provided in Section III and Table 4). With this in mind, the following summary of the research zones is presented.

The Bow Willow Wash area contains the highest overall frequency of activity loci. The predominant occurrences in this portion of the study area are the light flake scatters, and secondarily primary core reduction stations. In addition, high frequencies of various core and bifacially flaked specimens are also present. The most numerous of these are the amorphous cores and stage 2 biface forms, closely followed by other undesignated bifacially flaked tools. Additional tool forms are represented in lesser quantities. All the above materials are widely scattered over the entire length of Bow Willow Wash, with two especially extensive deposits--one at the head of the wash system near the lacustrine bed formation and the other further to the east where the wash widens as it exists the narrows formed by uplifted granite outcrops, just south and east of the SAD-1 rock shelter locus.

The Assembly Area cultural site systems show a predominance of primary core reduction stations, closely accompanied by light flake scatters. Amorphous cores, medium flake scatters, and secondary core reduction stations follow in frequency of occurrence; the remaining artifacts and features are present in lower, but still meaningful, frequencies. The cultural materials occur more homogeneously in this zone than the Bow Willow Wash deposits. However, a review of plat maps K-N does show limited clustering, albeit smaller in area, particularly in the northwest portion of plat map K and the northwest portion of plat map N.

Cultural debris in the Silver Lake Road area also exhibit a predominance of light flake scatters, followed by amorphous cores and primary core reduction stations as high percentage occurrences. Undesignated bifacially flaked specimens, medium flake scatters, and unidirectional cores also exhibit high to moderate frequencies of occurrence. Most of these specimens are located in one very large concentration, although other clusters or small concentrations are also evident. Materials shown outside the boundaries of site 4-SBr-4515 (Map B), for example, may reflect a continuation of the general pattern--now disturbed by modern erosion and transformation processes--or, rather, outlying activity areas in good context and with some measurable relationship to the greater body of the site (cf. Maps B-D, Appendix A).

As shown in the above text and in the statistics in Tables 9 and 10, all of the discussion area site systems exhibit similar profiles with regard to a hierarchy in activity regime. The higher frequencies point toward raw lithic quarrying activities as the primary extractive orientation. Also evident is that the prehistoric quarrying appears to be directed mainly at biface tool manufacture, as evidenced by the high frequencies of rejected early-stage biface forms. One common reason for high discard rates was suggested by Holmes (1919) in his classic study of quarry workshop refuse. Holmes noted that the "prevailing cause of failure" was loss of thickness-to-width ratio of biface forms in quarry sites. Holmes also mentioned other failures caused by the effect now termed "end shock phenomenon."

Note, however, that in addition to quarry and core reduction features (extractive tasks), numerous site localities were observed in this investigation with multiple-activity evidence. This is not wholly unexpected; Binford and Binford (1969) suggest that if sites such as quarries ". . . were occupied for a rather long period and by a fairly large subgroup, we would anticipate that some maintenance activities would be reflected in the archaeological remains" (1969:71). They further clarify that "Maintenance activities consist in the preparation and distribution of foods and fuels already on hand and in the processing of raw materials into tools" (Binford and Binford 1969:71). These activity loci are important because they permit inferences about cultural affiliation, demographics, duration of occupation, and

Table 9
ABSOLUTE AND RELATIVE FREQUENCIES OF PROVISIONAL ARTIFACT AND FEATURE DESIGNATIONS
WITHIN DISCUSSION AREA SITE SYSTEMS

Features/Artifacts	Bow Willow Wash Area (4-SBr-4204)	Assembly Area (4-SBr-4249)	Silver Lake Road Area (4-SBr-4515, -4516)	Combined Discussion Areas
Flake (isolated)	42 (04.13%)	23 (03.91%)	25 (04.59%)	90 (04.19%)
Modified flake-based tool	25 (02.46%)	22 (03.74%)	8 (01.47%)	55 (02.56%)
Biface flaked tool	51 (05.02%)	19 (03.23%)	65 (11.93%)	135 (06.28%)
Biface, stage 1	27 (02.66%)	11 (01.87%)	13 (02.39%)	51 (02.37%)
Biface, stage 2	52 (05.12%)	27 (04.59%)	23 (04.22%)	102 (04.75%)
Biface, stage 3	7 (00.69%)	1 (00.17%)	1 (00.18%)	9 (00.42%)
Scraper-like device	29 (02.85%)	5 (00.85%)	6 (01.10%)	40 (01.86%)
Planate tool	9 (00.89%)	4 (00.68%)	1 (00.18%)	14 (00.65%)
Hammerstone	29 (02.85%)	28 (04.76%)	17 (03.12%)	74 (03.44%)
Core (amorphous)	97 (09.55%)	55 (09.35%)	87 (15.96%)	239 (11.12%)
Unidirectional core	39 (03.84%)	10 (01.70%)	28 (05.14%)	77 (03.58%)
Multidirectional core	9 (00.89%)	3 (00.51%)	3 (00.55%)	15 (00.70%)
Platform core	3 (00.30%)	2 (00.34%)	0	5 (00.23%)
Patterned core	23 (02.26%)	8 (01.36%)	3 (00.55%)	34 (01.58%)
Primary core reduction station	195 (19.19%)	138 (23.47%)	77 (14.13%)	410 (19.08%)
Secondary core reduction station	37 (03.64%)	34 (05.78%)	9 (01.65%)	80 (03.72%)
Projectile point	3 (00.30%)	2 (00.34%)	2 (00.37%)	7 (00.33%)
Typological blade	5 (00.49%)	13 (02.21%)	0	18 (00.84%)
Light flake scatter	257 (25.30%)	131 (22.28%)	145 (26.61%)	533 (24.80%)
Medium flake scatter	57 (05.61%)	35 (05.95%)	25 (04.59%)	117 (05.44%)
Heavy flake scatter	10 (00.98%)	17 (02.89%)	5 (00.92%)	32 (01.49%)
Rock feature	3 (00.30%)	0	1 (00.18%)	4 (00.19%)
Cairn	7 (00.69%)	0	1 (00.18%)	8 (00.37%)
Total	1,016	588	545	2,149

Table 10
COMPARISON OF RELATIVE FREQUENCIES OF PROVISIONAL ARTIFACT AND FEATURE DESIGNATIONS BETWEEN DISCUSSION AREA SITE SYSTEMS

Features/Artifacts	Bow Willow Wash Area (4-SBr-4204)	Assembly Area (4-SBr-4249)	Silver Lake Road Area (4-SBr-4515, -4516)
Flake (isolated)	46.66%	25.56%	27.78%
Modified flake-based tool	45.45%	40.00%	14.55%
Biface flaked tool	37.78%	14.07%	48.15%
Biface, stage 1	52.94%	21.57%	25.49%
Biface, stage 2	50.98%	26.47%	22.55%
Biface, stage 3	77.78%	11.11%	11.11%
Scraper-like device	72.50%	12.50%	15.00%
Planate tool	64.29%	28.57%	7.14%
Hammerstone	39.19%	37.84%	22.97%
Core (amorphous)	40.59%	23.01%	36.40%
Unidirectional core	50.65%	12.99%	36.36%
Multidirectional core	60.00%	20.00%	20.00%
Platform core	60.00%	40.00%	0
Patterned core	67.65%	23.53%	8.82%
Primary core reduction station	47.56%	33.66%	18.78%
Secondary core reduction station	46.25%	42.50%	11.25%
Projectile point	42.86%	28.57%	28.57%
Typological blade	27.78%	72.22%	0
Light flake scatter	48.22%	24.58%	27.20%
Medium flake scatter	48.72%	29.91%	21.37%
Heavy flake scatter	31.25%	53.12%	15.63%
Rock feature	75.00%	0	25.00%
Cairn	87.50%	0	12.50%

land use priorities. Evidence for multiple-activity loci is reflected in the formal artifacts of lower frequencies and in the locational patterns of the specialized tool assemblages.

Multi-activity sites are useful in interpreting subsistence strategies, sedentary or transhumant, of those who created the deposit. This is important because: "If a hunting-gathering society were relatively sedentary, we would expect the tools at the base camp to exhibit little seasonal variation because the base camp would have been occupied for most of the year" (Binford and Binford 1969:71). On the other hand, deposits created by a transhumant population will indicate environmental conditions at that point within the seasonally directed cycle.

Further, if a sedentary or semi-sedentary population was responsible for the deposits under consideration, then questions about duration of occupation, or "ownership," should be clarified. This is important since ownership requires the ability (organizational infrastructure) to maintain holdings against trespass and the ability to exact compensation for allowing resource extraction by other non-aligned individuals or groups. Another possibility is that a resource zone was collectively or commonly shared, thus affording opportunity for interface among many differing peoples. Each of these variations presents different cross-cultural interaction mechanisms that may be distinguishable in the archaeological record. Widely varying commodities also have the potential to change hands through trade. This is another means to "open the door" for the exchange of ideas, information, and technologies. Additionally, dependent upon the ownership format, distribution of valued resources can contribute to political alliances between far-ranging socio-cultural entities, thereby strengthening the ability to maintain the base resource and other territory through reciprocal defense agreements. The above considerations should be understood to assist in evaluating the widely distributed activity concentrations on regional or sub-regional bases.

With regard to the levels of activity complexity, the deposits clearly exhibit a full range of activity sets, including biface tool, planate tool, and patterned core artifacts. In addition, except for superpositioning possibilities, the intense concentration areas mentioned above provide an opportunity to test associational hypotheses and establish parameters by which to define activity structures. However, the paucity of temporal and cultural association indicators has hampered delineation of clearly defined socio-cultural aggregates. Few specimens were located and documented that could formally establish direct affiliations with the activity sets or key implements through the cultural resources documented to date. Functionally specific data retrieval is necessary prior to identification and correct assessment and analysis of activity priorities in a differing

environmental setting. A best estimate appraisal is presented in the Interpretations section of this report.

LIMITED TEST EXCAVATION

Following the fieldwork executed in June of 1981, as detailed previously, two excavation test units were scheduled at Locus SAD-1 to inspect for subsurface condition and content. However, due to limitations of time owing to pending live fire training maneuvers, the two units were not possible and only one test unit was excavated. Locus SAD-1 is located in the Bow Willow Wash area on the Fort Irwin Military Reservation along a broad stream channel in the southeast corner of the No Name Playa basin (Figure 2, Appendix A). This resource is situated at the base of Hill 1023 in a granite outcrop at an elevation of 900 meters, northeast of the larger site complex 4-SBr-4204. SAD-1 is approximately 50 meters north of the present streambed in Bow Willow Wash, 500 meters southeast of the highest point of Hill 1023, and 3,200 meters southwest of Silver Lake Road.

The site consists of a large sheltering granitic boulder with midden along the eastern base and scattered flakes, flaked stone, and biface fragments on the surface. Affected area encompasses about fifty-six square meters (Figure 27). It is heavily disturbed by slope wash as a result of erosional/depositional activity from Bow Willow Wash during seasonal flooding and by military activities. A covered tank trap extending across the wash is three meters west of the locus. The site area supports species from the creosote bush scrub plant community.

The test unit was placed on a north-sloping margin of Bow Willow Wash and measured one meter north/south by one-half meter east/west. Prior to subsurface investigation, surface artifacts were mapped using an alidade and plane table. Artifacts were recorded and collected because of possible disturbance during excavation. Recovered surface artifacts include twenty-four secondary and eight primary flakes, twenty-seven pieces of debitage, seven tool-type artifacts, one core, one projectile point preform, and four osteological specimens. All lithic artifacts are chalcedony. Table 11 details these artifacts, and their positions within the locus are shown on Figure 27.

Surface soils consisted of loosely packed sands (Munsell code 10 YR 6/3) and a gravel matrix of decomposing granite, with granite cobbles on the surface and several large, deeply embedded boulders. Cultural materials and debris collected from the surface include 144 chalcedony debitage, 6 primary chalcedony flakes, 43 secondary chalcedony flakes, 3 osteological fragments, and 1 fifty-caliber military bullet (Table 12).

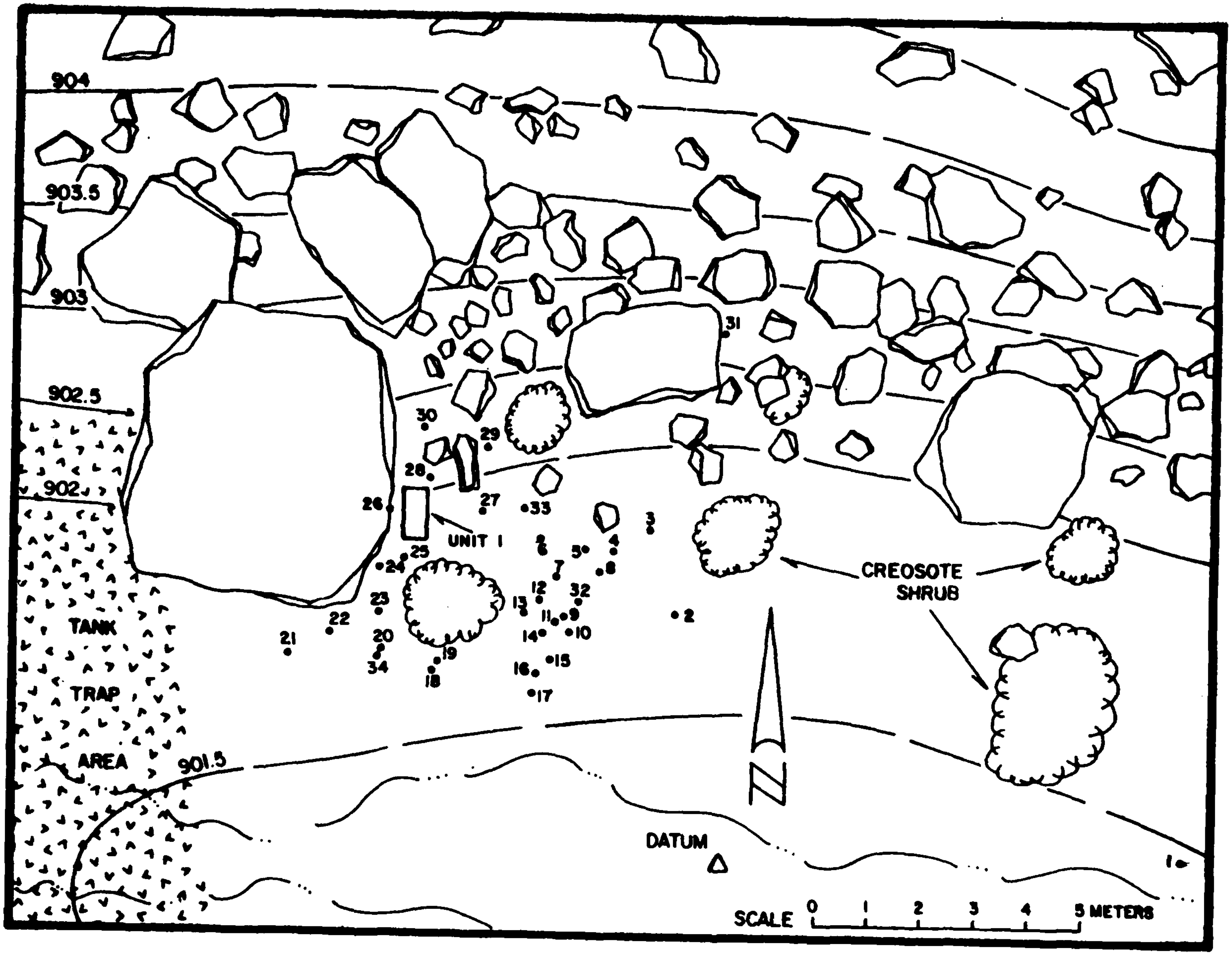


Figure 27

This illustration is based on a plane table map of Locus SAD-1. Numbers indicate positions of artifacts surface collected; see Table 11 for descriptions of each artifact.

Table 11
SURFACE ARTIFACT COLLECTION - LOCUS SAD-1

Map Shot Number*	Catalog Number	Cultural Debris	Material	Length (cm)	Width (cm)	Thickness (cm)	Weight (gm)	Quantity
1	33	Secondary flake	Chalcedony	4.9	3.2	1.4	19.2	1
1	34	Primary flake	Chalcedony	5.8	3.4	1.3	21.8	1
1	35	Bifacially flaked tool	Chalcedony	111.2	4.5	2.51	98.0	1
1	36	Debitage**	Chalcedony	--	--	--	5.6	1
2	84	Secondary flake	Chalcedony	2.3	4.2	0.7	7.0	1
3	75	Secondary flake	Chalcedony	5.3	2.8	0.8	10.8	1
4	77	Secondary flake	Chalcedony	2.8	3.4	0.7	5.2	1
5	81	Unifacially flaked tool	Chalcedony	8.7	6.25	2.73	156.2	1
5	80	Secondary flake	Chalcedony	3.2	2.9	0.9	7.4	1
6	78	Debitage**	Chalcedony	--	--	--	0.2	1
6	79	Bifacially flaked tool fragment	Chalcedony	5.44	2.25	1.32	12.6	1
7	66	Secondary flake	Chalcedony	3.2	2.0	0.4	2.2	1
7	67	Debitage**	Chalcedony	--	--	--	1.2	1
8	45	Secondary flake	Chalcedony	5.2	5.2	2.5	58.4	1
8	46	Bifacially flaked tool	Chalcedony	7.97	4.88	2.38	68.2	1
8	47	Bifacially flaked tool	Chalcedony	6.94	3.57	2.05	44.4	1
9	50	Primary flake	Chalcedony	2.7	2.8	0.8	3.6	1
9	51	Primary flake	Chalcedony	3.8	3.5	0.9	7.6	1
9	52	Debitage**	Chalcedony	--	--	--	1.6	1
10	53	Secondary flake	Chalcedony	2.6	3.1	0.7	4.6	1
10	54	Secondary flake	Chalcedony	3.4	2.0	0.3	1.2	1
10	55	Debitage**	Chalcedony	--	--	--	1.2	1
11	88	Debitage**	Chalcedony	--	--	--	1.8	2
11	87	Primary flake	Chalcedony	1.8	2.4	0.5	2.4	1
11	86	Secondary flake	Chalcedony	2.7	2.2	0.7	3.8	1
12	95	Debitage**	Chalcedony	--	--	--	0.6	1
12	94	Secondary flake	Chalcedony	3.5	2.1	0.5	1.6	1
13	85	Secondary flake	Chalcedony	2.1	1.3	0.3	0.6	1
14	93	Debitage**	Chalcedony	--	--	--	2.6	2
15	39	Debitage**	Chalcedony	--	--	--	3.0	1
15	38	Secondary flake	Chalcedony	3.2	1.7	0.4	1.8	1
16	40	Secondary flake	Chalcedony	1.8	1.4	0.6	0.8	1
16	41	Debitage**	Chalcedony	--	--	--	6.4	1
16	42	Osteological specimen	Large mammal	--	--	--	0.6	1
17	43	Secondary flake	Chalcedony	2.8	2.7	0.7	3.4	1

Table 11
SURFACE ARTIFACT COLLECTION - LOCUS SAD-1
(continued)

Map Shot Number*	Catalog Number	Cultural Debris	Material	Length (cm)	Width (cm)	Thickness (cm)	Weight (gm)	Quantity
17	44	Primary flake	Chalcedony	1.6	1.7	0.4	0.6	1
18	59	Secondary flake	Chalcedony	1.9	1.6	0.3	0.8	1
18	60	Secondary flake	Chalcedony	1.8	1.5	0.2	0.4	1
19	68	Primary flake	Chalcedony	2.3	2.3	0.6	2.6	1
19	69	Primary flake	Chalcedony	2.0	1.3	0.5	1.8	1
19	70	Debitage**	Chalcedony	--	--	--	0.4	2
20	90	Debitage**	Chalcedony	--	--	--	9.0	3
20	91	Bifacially flaked tool fragment	Chalcedony	6.54	2.0	1.87	24.6	1
21	57	Secondary flake	Chalcedony	1.7	1.9	0.4	1.0	1
21	58	Debitage**	Chalcedony	--	--	--	0.4	1
22	73	Secondary flake	Chalcedony	2.8	1.9	0.3	1.0	1
22	74	Debitage**	Chalcedony	--	--	--	0.4	1
23	37	Osteological specimen	Large mammal	--	--	--	0.4	1
24	63	Secondary flake	Chalcedony	2.2	3.3	0.5	4.2	1
24	64	Debitage**	Chalcedony	--	--	--	0.8	1
24	65	Projectile point preform	Chalcedony	2.0	1.3	0.39	0.8	1
25	71	Secondary flake	Chalcedony	3.7	1.7	0.4	2.8	1
25	72	Debitage**	Chalcedony	--	--	--	5.6	2
26	61	Secondary flake	Chalcedony	3.1	2.7	0.4	2.0	1
27	89	Debitage**	Chalcedony	--	--	--	4.0	1
28	83	Debitage**	Chalcedony	--	--	--	5.2	2
29	92	Secondary flake	Chalcedony	3.5	2.9	0.5	5.4	1
30	96	Primary flake	Chalcedony	5.0	4.0	1.9	24.0	1
30	97	Secondary flake	Chalcedony	3.0	2.5	1.1	7.0	1
30	98	Osteological specimen	Large mammal	--	--	--	1.8	1
31	56	Core	Chalcedony	10.5	7.1	6.2	4.5	1
32	48	Bifacially flaked tool	Chalcedony	11.59	6.3	2.52	138.4	1
32	49	Osteological specimen	Large mammal	--	--	--	0.2	1
33	82	Debitage**	Chalcedony	--	--	--	8.6	1
34	76	Debitage**	Chalcedony	--	--	--	2.6	1

*See Figure 27 for map shot locations.
**Debitage was not measured for length, width, or thickness.

Table 12
TEST EXCAVATION UNIT I - LOCUS SAD-1

Level	Soils	Munsell Code	Recovered Artifacts*	Ecological Materials	Comments
Surface	Loosely packed, dry, fine-grained sands with decomposing granitic matrix and large, deeply embedded boulders	10 YR 6/3	144 debitage 6 primary flakes 43 secondary flakes	3 osteological specimens 1 50-caliber military slug	Covered tank trap 3 meters west of test unit
0-10 cm	Same as surface	10 YR 6/3	114 debitage 4 primary flakes 23 secondary flakes 1 utilized flake 1 patterned ovate biface 1 bifacially flaked tool fragment	72 osteological specimens 1 coprolite specimen Charcoal 5 shrapnel fragments	Thin charcoal lens, 10x15 cm; 2 photographs taken of floor level
10-20 cm	Silt and fine-grained sands with decomposing granite pebbles	10 YR 6/4	123 debitage 7 primary flakes 35 secondary flakes 1 utilized flake 1 bifacially flaked blade fragment 1 bifacially flaked tool 1 bifacially flaked core	71 osteological specimens	Ash lens uncovered at 20 cm; rodent activity; massive granitic boulder protruding from east wall
20-30 cm	Fine silt and sands becoming moist and compact with granitic cobbles	10 YR 6/4	77 debitage 6 primary flakes 30 secondary flakes 1 core	38 osteological specimens 0.2 gm charcoal	Massive boulder consumes 7/8 of northern portion of unit; rodent activity; creosote roots
30-40 cm	Moist, fine-grained, compact silts and sands with granitic cobbles	10 YR 6/4	52 debitage 3 primary flakes 16 secondary flakes 1 desert side-notched projectile point 1 projectile point fragment	6 osteological specimens 1.2 gm charcoal 2 unidentified seed pods 2 land snails	Excavation of northern portion of unit discontinued at 38 cm due to massive boulder; creosote roots in southern half

Table 12
TEST EXCAVATION UNIT I - LOCUS SAD-1
(continued)

Level	Soils	Munsell Code	Recovered Artifacts*	Ecological Materials	Comments
40-50 cm	Moist, fine-grained silts and sands with granitic pebbles	10 YR 5/4	105 debitage 1 primary flake 12 secondary flakes 1 biface fragment	19 osteological specimens 3.5 gm charcoal	Southern portion of unit only excavated due to massive boulder

*All lithic materials are chalcedony.

Materials recovered during the excavation of the zero to ten-centimeter level include 114 debitage, 4 primary and 23 secondary flakes, 1 utilized flake, 1 patterned ovate biface, 1 bifacially flaked tool fragment, 72 osteological fragments, coprolite, charcoal fragments, and 5 shrapnel fragments. All of the flake-based artifacts are chalcedony. A thin charcoal lens measuring approximately ten by fifteen centimeters was also found in this level. The charcoal material was collected and packaged for later flotation analysis. Two photographs were taken of the first level floor before proceeding to level two.

The soils in the ten to twenty-centimeter level consisted of fine silt and sand (Munsell code 10 YR 6/4), with loose decomposing granitic pebbles. During the excavation of this level, a large boulder was uncovered that protruded into the unit from the east wall. Other disturbances consisted of two rodent burrows, one in the northwest corner and one in the southwest corner. Artifacts in situ include one bifacially flaked chalcedony tool and one bifacially flaked chalcedony core. Other cultural debris consists of 7 primary flakes, 35 secondary flakes, and 123 debitage, all of chalcedony, and 1 utilized chalcedony flake, 1 bifacially flaked chalcedony blade fragment, and 71 osteological fragments. A possible ash lens was uncovered in the northeast corner of the unit immediately north of the boulder at a depth of twenty centimeters. A small sample of this soil was taken for Munsell soil code identification (10 YR 5/2); the remaining portion of the lens was removed during the excavation of level three and packaged for future analysis.

Excavation of the twenty to thirty-centimeter level was hindered by the presence of the previously uncovered large boulder, which occupied seven-eighths of the northern half of the unit and extended into the southern half. The northern and southern portions of the unit were excavated and screened separately because of interference from this boulder.

Soil from this level was somewhat similar to previous levels, although more moist and compact, with a Munsell color code of 10 YR 6/4. A rodent burrow intersected the unit along the southern margin of the boulder. Creosote roots were exposed at a depth of twenty-six centimeters along the south and east walls of the southern half of the unit.

Cultural debris recovered from the third level consists of seventy-seven debitage, six primary and thirty secondary flakes, one core, thirty-eight osteological fragments, and 0.2 gram of charcoal. All lithic artifacts are chalcedony. None were located in situ, and a majority of the flaked artifacts were recovered along the western wall of the unit.

The soils in the thirty to forty-centimeter level remained relatively stable, with a Munsell color code of 10 YR 6/4, but

were moister with few cobbles. Excavation of the northern portion was discontinued at thirty-eight centimeters because the boulder now covered the entire northern half. Work continued in the southern half of the unit where three smaller granitic boulders were uncovered. Creosote roots were still apparent in this level.

A large quantity of artifacts were recovered from this level relative to the amount of soil removed. These include fifty-two debitage, three primary flakes, sixteen secondary flakes, one desert side-notched projectile point, one projectile point fragment, and six osteological fragments. Again, all lithic material is chalcedony. Miscellaneous ecological data include two land snails, two seed pods (unidentified), and 1.2 grams of charcoal.

Excavation of the test unit continued to fifty centimeters in the southern portion only due to the granitic boulders throughout this level. The soil was moister and darker in the forty to fifty-centimeter level, consisting of fine silts and sands and a few granitic pebbles, with a Munsell color code of 10 YR 5/4. A rodent burrow dissected the unit in an east/west orientation along the southern margin of the massive boulder, and the creosote roots were still present in the southern wall. Artifacts include 105 debitage, 1 primary and 12 secondary flakes, 1 biface fragment with edge damage, all of chalcedony, and 19 osteological fragments and 3.5 grams of charcoal.

As previously stated, two additional twenty-five-centimeter-square tests were excavated and screened in an effort to further delineate the locus boundaries. Test one was located six meters west of the southwest corner of the excavated unit and halfway up the talus slope from the tank trap. This test was negative. Test two was located in a rodent mound at the base of a large boulder twelve meters west of the southwest corner of the excavated unit. The results were positive, and artifacts recovered include three secondary chalcedony flakes, three osteological specimens, and one unidentified plant seed.

INTERPRETATIONS

Completed research within several zones of the Live Fire Maneuver Range (LFMR) has resulted in the identification and documentation of twenty-five cultural resource sites. For certain previously recorded resources (4-SBr-4204, -4249, -4515, and -4516), this effort amounted to the recovery of additional documentation as requested by National Park Service representatives (Davis, Eckhardt and Hatley 1981; Hanna et al. 1981). Program evaluation, results of analysis, and resource site assessments are discussed in Section VI below.

Size and scope of project requirements demanded a broad-based anthropological approach. The cultural record in the Bow Willow/Assembly and Silver Lake Road regions was sampled according to an explicit research strategy using intensive survey, mapping and documentation, and limited test excavation techniques. Even without an existing base-wide cultural inventory, and with no allowable provision for use of data recovery-level programming, the resources reported for the current study areas represent complex structures of activity and behavior (primarily) from the prehistoric past. It is unfortunate that questions of relationship between and within sites are difficult to interpret and that total assemblage chronology remains almost unapproachable. Nonetheless, supportable interpretation suggests unknown periods of human activity from the historic period to as early as terminal Pleistocene times (i.e., early twentieth century to roughly 10,000 years before present).

Intensive pedestrian survey recorded nearly one hundred cultural resources in two nearly adjacent regions (see Figure 5 and Figure 1, Appendix A). These resources are primarily isolated finds, with less than one-third classifiable as sites (cf. Appendix B). Most of these resources indicate extractive activities directed at procuring foods, fuels, and raw materials for tools. Utilized flakes, scraping tools, projectile point fragments, light flake scatters, and core reduction stations may reflect the strategy of outlying limited use areas for collection and hunting within reasonable distance of work or base camps.

The only major sites were found at the southern end of Bow Willow Wash. Sufficient evidence was uncovered to infer activities more closely related to preparation, processing, and distribution. Small pockets of residues suggesting work camps (e.g., rock rings, slightly larger flake scatters, or the presence of more refined artifact types) were also found in a few locales.

No pottery was discovered, and--apart from groundstone (found in both isolated and site conditions)--no diagnostic artifact types or technologic peculiarities were identified that would support any true chronological determinations. This absence of temporal control creates some problem when questions of relationship between survey-level resource sites and those subjected to additional documentation are considered. Are the assemblages temporally similar? Do they represent use of specific resource areas over long periods of time? These questions are discussed below.

Mapping, documentation, and recording procedures were conducted for several large zones within the LFMR region. A tremendous inventory and assemblage has been reported, representating both extractive and maintenance tasks. Provisional tool categories include flake-based tools, planate items, hammers, projectiles, and groundstone; residues consist of refuse scatters, four

kinds of cores, broken bifaces, core reduction areas, and rock features. Broad areas of informal quarry activity, with occasional camp sites (multiple use), line the truncated alluvial fans which terrace much of the Bow Willow Wash stream channel (4-SBr-4204 and -4249). This is mirrored in the 4-SBr-4515 and -4516 assemblages (located to the north along Silver Lake Road), except that residues indicating maintenance tasks or camps were not reported in relative number (cf. Hanna et al. 1981:175-176), and local physiography does not include a major, relict stream channel.

The resource sites subjected to redocumentation do, however, have one value in common; they all rest on older fanglomerates of Plio-Pleistocene age (Jennings, Burnett and Troxel 1978) that contain large amounts of useful siliceous clasts. These older fans have been preserved by uplifting (faulting) which removed them from the present-day erosional (cut and fill) regime and must have been known to indigenous populations for centuries as sources of useful material for flaked stone tool manufacture. As noted by Abbott with reference to site 4-SBr-4515:

> The chert clasts are silicified limestones some of which contain fossils . . . . Some chert gravels are untouched but most of them have been broken to pieces apparently during the manufacture of tools by humans (Abbott 1981:22).

Reiner noted that for most of the Bow Willow/Assembly and Silver Lake Road zones, the raw lithic availability, coupled with various stage discard rates (wasting a lot of marginal to very good quality stone), suggests that the region may have been a "rich" lithic resource procurement area (Reiner 1981:personal communication). How would this relate to ownership considerations discussed earlier? For which cultures and for what temporal periods were these quarry sites in use?

Although several refined projectiles of seeming Paleo-Indian periods (e.g., Haskomat and San Dieguito) were recovered from a single fan in the Assembly Area, these cannot freely be construed as evidence of only Paleo-Indian use. Other "index fossils" of more recent periods were reported (and in some cases recovered) from other fans. Near the southern end of the Assembly Area a flake-based scraping tool was recovered that is remarkably similar to others found near Lake Manix to the south (Simpson 1956) and along the southern California shoreline (Moriarty 1962), a "type" frequently relegated to the Early Prehistoric period. At the north end of Bow Willow Wash, several fragmented projectiles were found that appear to be of the Pinto style, typical of the early Desert Culture (Jennings 1964) enterprise. With so few diagnostic indicators in the observed assemblages, it is clear why some researchers work to avoid the "index fossil" approach

and apply energies to more detailed analyses of the entire assemblage (Binford and Binford 1962:77-78).

Subsurface test excavation was severely limited for reasons stated above. Only a single sample test unit was excavated, but it provided positive results. Located at a rock shelter along the northern edge of Bow Willow Wash, the unit manifested midden development to at least fifty centimeters, with a large number of debitage and other small wastes (e.g., osteological remains) not found on the surface of the terraced alluvial fans. In addition, one projectile point (Desert Side-notched series) was recovered several levels below the surface, adding to the chronological puzzle. The temporal/cultural relationship of this locus to the remainder of Bow Willow Wash is unknown, although larger biface forms from both areas show greater similarities than differences. The rock shelter may represent more recent exploitation from long-used quarry regions than that represented by the work camps and multiple-use areas found exposed on the fans and referred to earlier.

The question of temporal/cultural relationships was put to geomorphologic assessment, but with less than adequate results. Geomorphologic reconnaissance and assessment was hamstrung from the beginning, there being no provisions for geologic trenching or stratigraphic profile analyses. Using only aerial photographs, geologic sheets, topographic maps, limited reconnaissance, and exposed profile analyses or straticuts, none but the broadest comments could be generated. Considering the alluvial fans in the Assembly Area, it was roughly estimated that cultural debris on some well-preserved segments might be as old as 15,000 years based on relative development of pavement surfaces, incorporation of artifacts into pavement matrices, and existing modern-day erosional regimes (Shlemon 1981:personal communication). Reconnaissance of several fans both north and south of the relict stream channel disclosed numerous zones where pavement formation was extreme, vesicular horizons well developed, and cambic layers present of varying depths and development. Petrocalcic horizons were found close to the surface (twenty to twenty-five centimeters), but detailed inspection was restricted.

Exposed profile analyses added further data, but did not significantly enhance interpretation. At 70 to 120 centimeters below the "average" preserved fan, a tremendous calcrete plug (estimated eighty centimeters in thickness) was observed which, given existing physiography and program limitations, could not be easily explained. With the age and extent of the Plio-Pleistocene fanglomerate formations in mind, it is unfortunate that this line of research could not be pursued. However, given the level of analysis permitted, it is possible that the Bow Willow Wash system was previously isolated from major stream flows of upland lake systems (Drinkwater and No Name lake basins) (cf. Abbott 1981:6-11). Brought about by either tectonic activity or

sedimentation (or both), the flow from Drinkwater basin probably shifted eastward, downslope, and worked to increase intermittent drainage patterns and create a major stream channel. Evidence to support this working hypothesis is gleaned from recognizing certain physiographic elements relative to that scenario--aging lineaments, varying differentials in erosional regimes within Bow Willow Wash, fan stability, and condition of desert pavement systems. Although geomorphologic assessment possesses great promise in interpreting the relative age of the resources and might allow development of formulae to assess questions of temporal/cultural relationships, greater allowance must be made for the intricacies, energies, and expenses necessary to achieve these ends.

Replicative experiments have been heavily relied upon in the current effort to deduce variations in cultural residues resulting from differing stages of reduction and varying technological approach. Recognizable indices in flaked stone refuse have been identified that have the potential to increase or refine the understanding of the resource sites at hand. It may even prove possible to determine technological approaches and modes in flaked stone tool manufacture when discoveries exclude the objective pieces. And yet the current level of analysis can develop no more than "provisional" artifact types, owing to the need for rigorous testing of provisional types in order to secure acceptable confidence and reliability in this classification scheme.

Two broad "types" worthy of more detailed consideration are cores and biface forms. Current divisions in these types are as yet inadequately refined, especially considering their potential to elucidate issues of curation, portage, and trade. The dearth of platform cores, for example, may suggest that suitable quality materials, once prepared for patterned, platform flake removals, were valuable resources not to be idly discarded. Similarly, bifaces from stage 3 through 5 reduction are noticeably lacking from the entire assemblage. What cultural practice (if any) best accounts for this circumstance? The existing level of documentation, experimentation, and interpretation needs to be explicitly tested before meaningful inferences and refined understanding may be achieved.

Left with more questions than answers, it may be said that the resource inventory of this portion of the LFMR certainly generates or contains valuable scientific potential well beyond the reach of surface-oriented intensive documentation techniques. Inasmuch as several of the resources (4-SBr-4204, -4249, -4515, and -4516) represent major quarry localities in relatively excellent context and condition, the region-wide value of these resource sites is all but self-explanatory. Further analysis of this region should focus on explicit and intensive sampling programs and large-scale data recovery efforts, coupled with detailed statistical approaches and the preservation of (at least) representative samples for later review and further research.

SECTION VI

PROGRAM EVALUATION AND ASSESSMENT

The twenty-five cultural resource sites and sixty-seven isolated finds presented in the preceding section represent the known cultural resource inventory of the several study zones (see Figure 5 and Appendix A). Using previous survey data (Davis, Eckhardt and Hatley 1981; Hanna et al. 1981) and a formalized research strategy (Section III) for direction and focus, these resources were subjected to documentation and interpretation to assess their potential eligibility for nomination to the National Register of Historic Places.

Although this inventory of cultural resources is not unique within the northwestern Mojave Desert, several factors suggest that the pattern, content, and extent of these resources are highly sensitive and of great scientific import to the continuing evaluation and assessment of both historic and prehistoric populations in the New World. Isolated finds and resource sites include a historic spectrum and certain prehistoric aspects that may date to as early as 15,000 years before the present. Among the isolates and sites recorded is an observable pattern of resource exploitation well preserved by the military reservation boundaries which restrict access and limit resource disturbance. A number of large quarry workshop areas subjected to additional documentation present intricate detail of flake stone technologies and lithic procurement patterns within the confines of major float lithic source quarry zones, a phenomenon infrequently reported for this region and perhaps rarely discovered on so grand a scale.

In the discussions to follow, results of the current study are summarized and considered against the inventory program's stated goals and requirements (see Sections I and III). Significance assessments of each cultural resource site are also presented to facilitate proper resource management, as defined by Federal law (Public Law 86-665, Executive Order 11593, and 36 CFR 800) and military regulation (Army Regulation 200.1).

RESULTS OF ANALYSIS AND STATED GOALS

Analysis of information and material assemblages recorded and in some cases recovered during the current field investigation focused on provisional classification of features and artifacts, recorded environmental and contextual data, extent and pattern of deposit, and application to theoretical development of propositions presented earlier (Section III). Because artifacts, features, and sites are not all temporally or geographically

related, they will be summarized on the basis of temporal or geographical groupings to facilitate discussion.

For the most part, the resources examined in the LFMR area are located in a region where soil deflation and desert pavement formation prevail. Under such conditions, culturally related deposits are dispersed or radically consolidated; the organic cultural residues, once preserved through burial, are exposed, break down, and dissolve. The effect of this process is, of course, more destructive over time. For example, historic resources fare better than older prehistoric resources. Thus, interpretation of the cultural resource inventory must be developed through analysis of artifacts and features, the residues of their manufacture or use, landforms and physiography upon which they are located, and spatial relationships within and between discrete site locations.

Historic cultural remains in the LFMR (see Figure 1, Appendix A) consist primarily of stacked rock features, although two pick heads (one with a deteriorated wooden handle still in place) and six pieces of fragmented purple glass were also reported and recovered. Stacked rock features recorded for this period occur as claim markers or cairns (Photograph 6) and are also found as parapets used in military training exercises for individual or squad-size rifle positions (Photograph 7). Claim markers for mineral or property boundaries traditionally consist of stacked rock monuments or cairns, frequently with a post placed in the center and, as required by law, copies of the deed, claim, or registry stored in a container kept within the monument. With the passage of time, center posts deteriorate or are borrowed for other uses (frequently for another's claim marker), and claim registrations are often removed and destroyed in the competition for valuable land or mineral rights. These factors tend to cloud the identity of historic claim monuments, leaving them easily confused with prehistoric cairns, unless their discovery is associated with other debris more easily recognized as historic (Photograph 8). A total of five cairns or claim markers were recorded during survey (4-SBr-4727, -4728, -4741, -4747, and -4748) in the Silver Lake Road region, and a sixth cairn was recorded within the boundaries of prehistoric site 4-SBr-4249.

Two pick heads were recovered from different areas adjacent to Silver Lake Road, one as an isolate in the foothills of the Avawatz Mountains and the other adjacent to a mining claim some twelve kilometers to the south within site 4-SBr-4249 (Photograph 8). The pick head discovered adjacent to a claim monument is still attached to a severely dessicated and brittle hardwood handle. Although no shims remain in the head of the handle and no scars from such mounting can be discerned, a single leather fragment (possibly recycled boot leather) was discovered as a lateral shim near the thickest portion of the handle shank. Both pick heads appear to have been finished by manual grinding and

Photograph 6: The stacked rock features in this photograph are located in the Bow Willow Wash area. Note that the cairns are composed of larger boulder-size rocks than can be found on the immediately surrounding desert pavement, suggesting that the boulders were carried to this specific location. No prehistoric materials were observed in association with these cairns. The scale in the center foreground is 25 centimters.

Photograph 8: The miner's pick head and attached wooden handle found in close association with the stacked rock cairn illustrated in this photograph identify the cairn as a historic feature, probably a miner's claim marker. No prehistoric artifacts were located in the immediate vicinity. The cairn and pick were recorded within site 4-SBr-4249.

Photograph 7: Shown in this photograph are two gun positions located on a low terrace in the Bow Willow Wash area. A flake scatter at the foot of the feature on the right has been severely disrupted by the construction of these military features.

pounding--possibly hand-wrought (as opposed to drop-forged)--and bear maker's marks consisting of a six-pointed star with the words "Iron City." These items probably date from ca. 1860-1920, although more refined temporal placement can no doubt be obtained through research into maker's marks and records detailing dates and names for local west coast distributors.

At a separate locale along Silver Lake Road, an isolated find of six purple glass fragments was recovered from an alluvial fan surface slightly above an active modern intermittent drainage. The fragments are not large, weighing only twenty-six grams total, with no seams, basal fragments, lips, or scroll discernible. Nonetheless, some features are identifiable which may be useful in refining the items' temporal placement. A partial reconstruction was attempted, reducing the six fragments to four.

The largest of the fragments appears to come from the base of the neck of a storage container or jar. Two fragments refitted span the height from the neck base to--perhaps--the base of the lip and suggest this jar had a thick lip for a screw-shut lid. The base of the neck is stylized, comprised of three undulations becoming broader in diameter (relative to the jar) from top to bottom. Below this, the body of the jar changes from circular to (possibly) hexagonal in shape. Evidence of this style change is scanty; a single angle and two short lateral edges are all that remain. However, the last fragment, which does not refit to any other piece, exhibits the same angle and lateral edges, enhancing the potential of this interpretation. Several bubbles within the glass are observable in these fragments but no seams have been ascertained. The glass no doubt will fit within the time frame proffered for the pick heads and cairns, but further temporal refinement must await more detailed study and research.

Many sites and isolates representing prehistoric indigenous activities were found during the intensive survey of Silver Lake Road and High Pass Road. Sixteen sites and sixty-five isolated finds were reported for this region, increasing the total prehistoric cultural resource inventory recorded in earlier studies (Davis, Eckhardt and Hatley 1981; Hanna et al. 1981). These suggest indigenous prehistoric populations well aware of local float lithic resource zones for procurement of suitable flake stone material and who may have engaged in exploiting other natural resources for food or construction purposes from the surrounding environments.

From the isolated finds, 140 artifacts were recovered, cataloged, and subjected to preliminary analysis. Roughly 82 percent was provisionally classified as production waste (technical flakes, debitage, and cores) and the remainder as tools (unifacial, bifacial, and cobble-based tools and groundstone). Cortex-backed (primary) flakes and debitage comprise the greater

portion of the assemblage (thirty-one and forty-nine, respectively) and suggest activity focused on lithic material procurement. These figures coincide with findings noted from the larger quarry zones subjected to additional documentation (see Table 9), although survey-level findings show a greater percentage of flake-based tools among the isolated finds than reported elsewhere.

Table 6 adds further support to the notion of outlying extractive tasks with a measurable focus on resources other than lithic material. Of the sixty-five prehistoric isolated finds recorded and recovered during survey, twenty-four consist of isolated tools, including utilized flakes, unifacial and bifacial tools, metates, and a cobble-based hammerstone-pounder. An equal number of single flakes or cores was located, and seventeen localities were classed as primary (fourteen) and secondary (three) lithic reduction stations.

Utilized flakes are the most common isolated tool, classified on the basis of edge damage, edge rounding, and straightening of the leading edge. Flakes probably used once or only briefly were not classified as utilized, and some error may thereby derive to the detriment or diminution of this tool category. Utilized flakes are frequently inferred to be informal tools for cutting, drilling, slicing, or sawing of small- to medium-size material, including leaf matter, wood, reed, stalk, or hide. The flakes are primarily small, most with more than one leading edge, occurring on both primary and secondary flakes. One remarkable specimen (SBCM-4984-1-121) is a biface-based flake with damage on its left lateral edge (right lateral edge is shattered). Analysis of the platform and dorsal side of this specimen shows distinct scarring and angular buildup reminiscent of biface reduction; furthermore, a diagnostic lip and bulbar curvature follow from the platform on the ventral surface and the flake is extremely thin (0.68 centimeter). These attributes, uncommon in the assemblage, may be attributable to biface form reduction, suggesting that early-stage bifaces may also have served as cores for the manufacture of useful flakes--either fortuitously or otherwise.

More formalized unifacial and bifacial tools were also noted among the isolated finds. Unifacial items consist of planate tools with both single and multiple leading edges, most frequently inferred to be tools for scraping and planing fiber or hide. All specimens in this assemblage are small work pieces (less than six centimeters in length), characterized by smooth ventral (flake) surfaces, with dorsal ridge masses, step fracturing, edge rounding, and either concave or convex curvatures on their leading edges. In the bifacial tool category, both biface/knives and a single projectile point fragment were recovered. Biface flaked tools (except for projectile points) are used in much the same way as are utilized flakes, but are

frequently more robust and therefore thought to be used in more formidable tasks, such as construction, dressing carcasses, and so forth. The single projectile recovered is not temporally diagnostic and is fragmented and incomplete. This specimen is irregularly weathered and the less dense lime formations within the parent siliceous materials have become greatly eroded. Fracture near the proximal region precludes type classification within type styles developed for the northwestern Mojave Desert region.

Two groundstone platforms were recovered, one of which has been bifacially used. Evidence of grinding on both of these platforms is limited to a flattening of the granodiorite crystals, forming a rounded, plate-like (metate) platform. Inferred usage of metate surfaces includes grinding small, soft seeds (i.e., chia, buckwheat, saltbush), crushing or pulping fruits and leaves (i.e., mesquite, yucca, agave), and pulverizing small game.

On the basis of the tool and artifact forms discussed above, it appears that a broad spectrum of exploitive processes associated with food or construction material procurement took place throughout the region. The isolated nature of the cultural occurrences, as opposed to a closely focused or clustered pattern, suggests that these activities were performed by individuals or small-groups, perhaps as part of a food procurement round based from nearby camps or multiple-use sites in the surrounding area.

Evidence of flake stone procurement patterns is well established throughout the several study zones and has been subjected to additional documentation at three major locations: the Bow Willow Wash zone (4-SBr-4204), Silver Lake Road area (4-SBr-4215 and -4216), and Assembly Area (4-SBr-4249). In addition, sixteen sites from the Silver Lake Road and High Pass Road areas, reported earlier (see Section V), also have been interpreted as evidence of lithic procurement activities. These resources represent a rich and valuable inventory of well-preserved sites, with sufficient variability and context to add greatly to an explanation of indigenous behaviors associated with the collection and manufacture of raw lithic material into useful tools and instruments.

As discussed in Section V, the lithic scatter is the predominant artifactual occurrence within the float lithic source quarry zones. Lithic scatters are further classified as primary or secondary types on the basis of evidence within the refuse. Frequently, these scatters are accompanied by objective work pieces, such as cores or bifaces, from which core reduction activity can be reconstructed. This pattern is a familiar image from most flake lithic quarry sites reported in the literature (Holmes 1919; Heizer and Treganza 1944; Bryan 1950; Davis, Brott and Weide 1969), although greater attention to analysis and

classification of quarry refuse and associated artifacts is called for if the purpose and full use range of these sites is to be determined (Bryan 1950:31-33).

For the current investigation, five provisional classifications or types of cores have been identified: amorphous, unidirectional, multidirectional, platform, and patterned (see Section III, Table 4, and Figure 4). As Table 9 shows, amorphous cores are most frequent in all three float lithic source quarry areas. Although this may be in part due to recording error, there is confidence that a majority of the core assemblage will fall within this category. It is the nature of the quarry source itself, where clasts occurring as float within and atop the alluvial fans are purposefully flaked several times or in some cases cleaved to reveal their inner matrix. A number of removals may be made for this inspection, and any suitable pieces may be worked further, while the remainder is discarded. This phenomenon has been noted elsewhere in the Mojave region (Davis, Brott and Weide 1969:22, 50; Smith 1980:personal communication) and is common to other North American quarry sites as well (Holmes 1919; Bryan 1950).

Unidirectional and patterned cores are also strongly represented in the Bow Willow area, and the unidirectional core is prevalent in the Silver Lake Road areas as well. Most unidirectional cores observed within the study areas are from tabular cobbles, where flake removals proceed from a single edge and in one direction (striking platforms all leading away from the same plane), with reductions continuing until a loss of suitable platform angle has developed or the objective piece is exhausted. Patterned cores, that in some cases derive from modification of unidirectional forms when the platform angle becomes problematic, are also most frequently found on tabular or angular material. Flake removals are analogous to those for unidirectional cores, except reduction proceeds from alternating directions.

Two core styles developed for this study's provisional typology warrant further discussion: multidirectional and platform cores. Multidirectional cores are variously plate-like or biconical in plan view and bear scars from flake removals in two or more directions (Photograph 9). A multidirectional approach is possibly the most fortuitous in core reduction, allowing the worker a wide range of angles to approach subsequent flake removals, providing alternate platforms to accomodate irregularities or imperfections within the objective piece, but limiting a knapper's control of form or style in the resulting flakes.

Platform cores, on the other hand, show a detail to approach and foresight not inferable to less formal application of core reduction (Photograph 10). One remarkable specimen of platform core reduction was recovered from the low-lying terraces in the Assembly Area (4-SBr-4249-1-63, -64, -65, and -66), consisting of

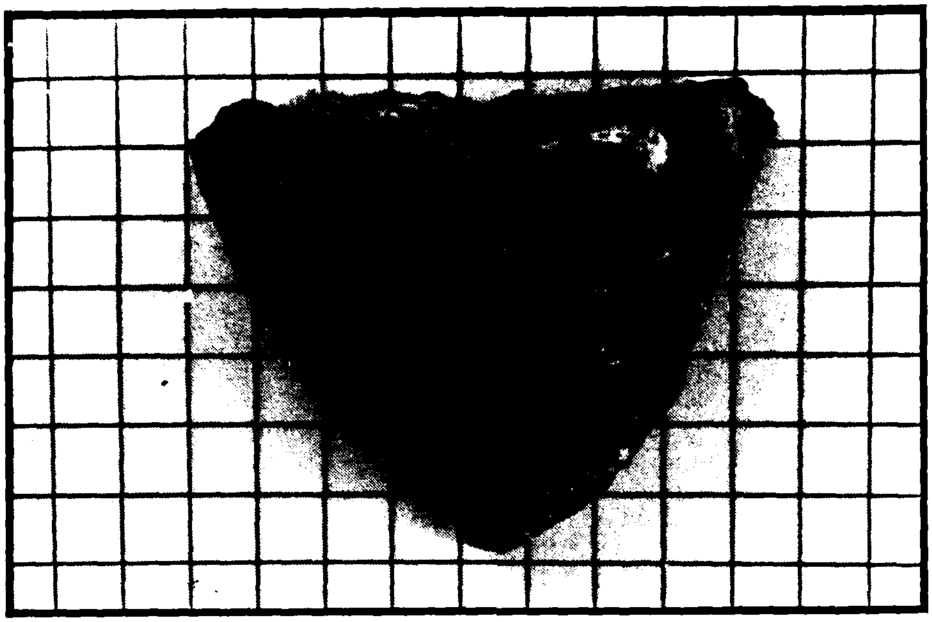
Photograph 9. This photograph illustrates a multidirectional, bifacially flaked core located in situ. The black specks in the lithic material are natural fissures and impurities. The partially embedded cobbles (top center and top rignt) are elements of the moderately to well-developed desert pavement matrix of irregularly sized, subrounded clasts.

Photograph 10. This chalcedony patterned core was collected from site SBr-4249 (4-SBr-4249-1-069). Notice the long, blade-like flake removal scars and the almost-expended nature of the core. Impurities in the lithic material are also evident in this photograph.

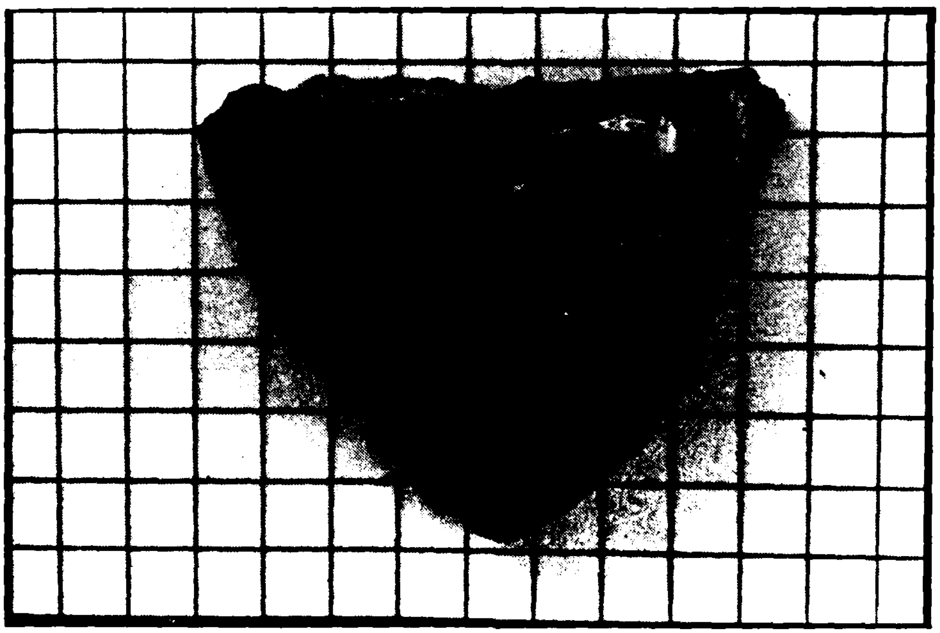
a single core and three flakes. The reduction process has been replicated in photo series to accompany discussion (Photographs 11, 12, 13, and 14). The platform core had previously undergone preparation, with development of two major platform areas, one of which is perpendicular to the longest axis of the work piece. From this platform, three faces and three angles were provided, of which only one was free of cortex. Several short scars receding from the platform on this noncortical face attest to attempts at flake removal, but it appears the platform angle, being too obtuse in this aspect, would not support the downward force of energy to result in any removals greater than 1.5 centimeters in length. Directly opposite this cortex-free face, the two cortical faces join in an aspect where the platform angle was sufficiently acute to support flake removals, as evidenced by the reduction sequence shown in Photographs 12 and 13. Following the third flake removal, failure of the platform angle (becoming too perpendicular?) and irregularities in the arris ridge (from previous flake removals) forced subsequent removals to truncate and step hinge far short of the base of the core (Photograph 14). As is probably natural in source-rich quarry zones, the core seems to have been discarded at this point, as suggested by the minor number of flake removals and its presence close to three of its primary flakes.

Patterns of fracture, failures in reduction, and lithic source selection are also prominent in biface forms as well as cores. Davis has suggested that ovate bifaces are a generalized technological trait, long in existence as a technique in tool manufacture and ubiquitous in occurrence throughout the New World (Davis, Brott and Weide 1969:35). A previous section of this report (IV) detailed steps in biface reduction from a viewpoint of manufacture, and the reduction stages are used here to further categorize the provisional classification of the biface forms under discussion. Throughout the major float lithic source quarry zones subjected to additional documentation, slightly less than three hundred bifaces (excluding stage 4 and 5 projectiles) were recorded. This number might have been significantly increased but for the requirement to document the broader spectrum of refuse and not simply focus attention on the more celebrated forms. Nonetheless, it is interesting that this category closely approximates the total number of cores (363) identified for the same site regions.

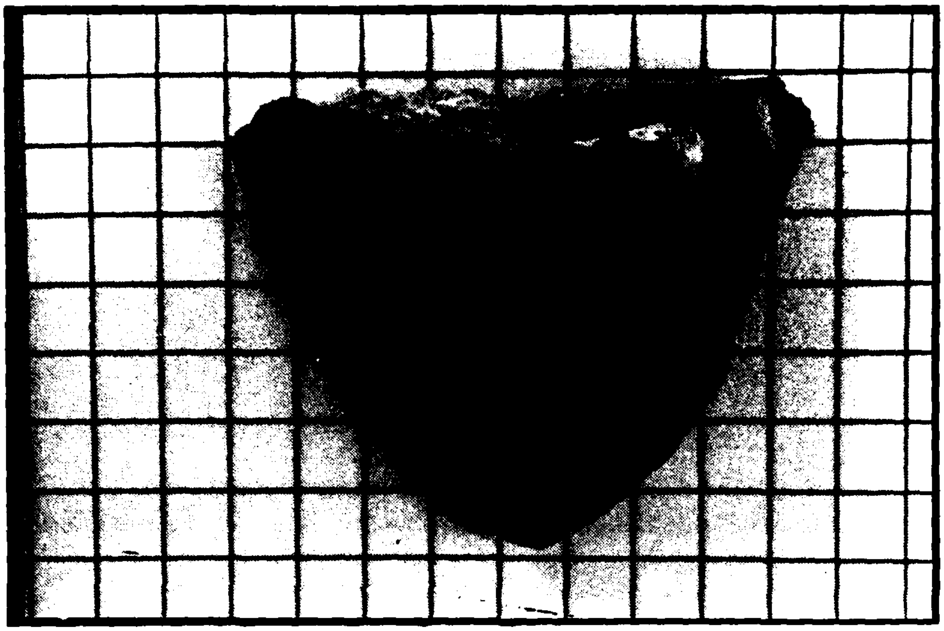
Stage 1 biface forms may have frequently been created as indigenous workers sorted likely siliceous clasts to choose those containing the greater number of desirable qualities for later stone tool manufacture (Photograph 15). Plate-like clasts and large macro-flakes were both employed for this purpose (see Figure 3), and a good deal of work might take place before a biface was rejected as poor grade (Photograph 16), found to be lacking in qualities of conchoidal fracture or fissure-ridden, and internally inconsistent.



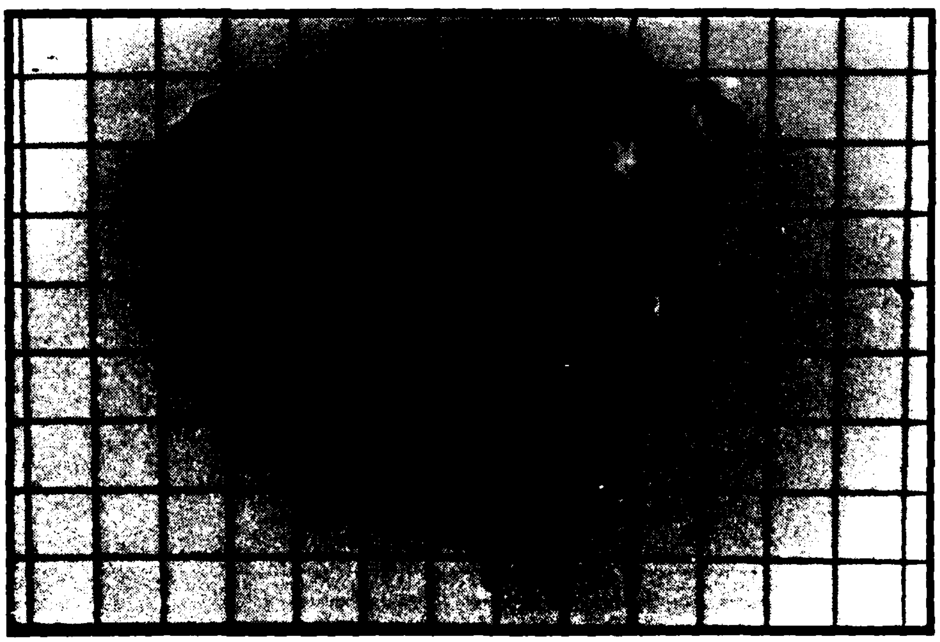
Photograph 11. Prior flake removals and platform preparation are visible on this platform core recovered from SBr-4249. Subsequent reduction removed three additional flakes, as depicted in the following three photographs.



Photograph 12. This photograph illustrates the first primary flake removal from the patterned core previously discussed. See the text for further discussion of the reduction process.



Photograph 13. Continuing the core reduction, a second primary flake has now been removed from the patterned core, as further discussed in the text.



Photograph 14. A final primary flake was removed from the right aspect of the core. Subsequent flake removals resulted in truncation and step hinges, as seen in the central portion of the core.

Photograph 15. Several flake removal scars and a small area of cortex are visible on this stage 1 biface. The artifact is situated within a loose desert pavement of various size, subrounded clasts.

Photograph 16. Still within the first stage of biface reduction, numerous flakes were removed from this felsite artifact prior to abandonment. The biface was photographed in situ within a moderately developed desert pavement.

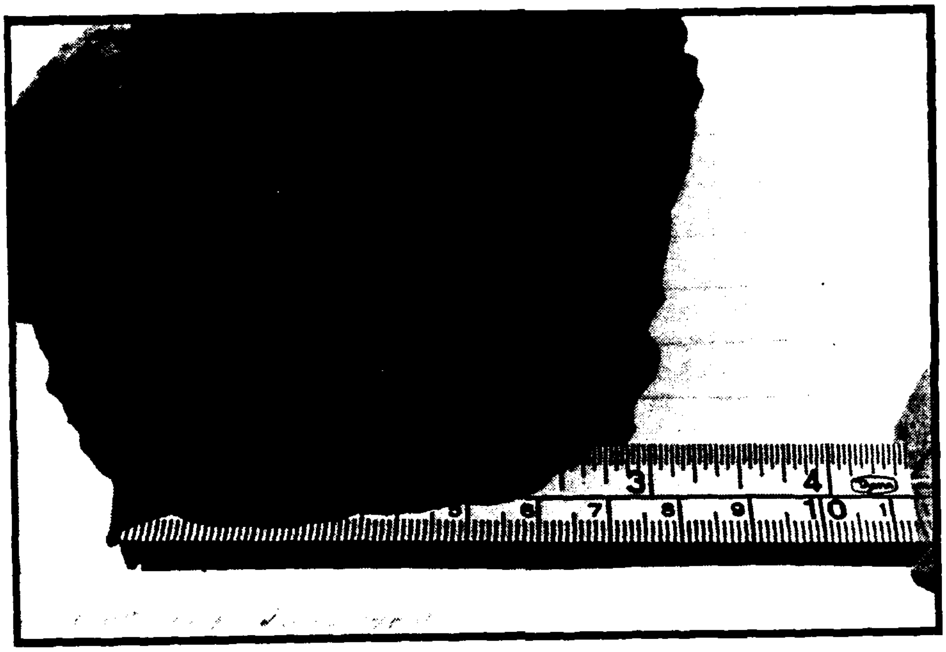
Stage 2 biface forms were frequently noted at all three float lithic quarry zones (Table 9). As discussed in Section IV, these stage 2 forms show multiple scars from flake reductions and the development of lenticular cross sections and lanceolate or ovate profiles (Photographs 17 and 18). William Holmes in his work for the Bureau of Ethnology suspected these forms were quarry blanks (1897:13, 18), to be transported from the quarry and further reduced into particular tool forms elsewhere. This inference was seriously questioned by Bryan (1950) and others (Davis, Brott and Weide 1969), who felt these forms represented wood working tools for the construction of other than flaked stone instruments (cf. Crabtree and Davis 1968). By appearance the similarity between some stage 2 biface forms (Photograph 17) and the Acheulian hand axe of Old World Paleolithic periods is remarkable. Nonetheless, from current investigation it appears that a significant number of these forms are but stages of reduction. Tools were recognized in the biface series recorded for this study, but were so designated on the basis of edge damage, edge rounding, and evidence of reworking (Photograph 19). Provisionally classified as biface flaked tools (Table 9), this category is unbounded by definitive stages of biface forms and occurs in various shapes and sizes.

The deduction of a biface series wherein later reduction into refined artifact forms is inferred gains some support from the relative absence of stage 3 forms at each of the float lithic quarry sources. As discussed earlier (Section IV), stage 3 forms are most delicate and subject to end-shock and fracture at greater rates than earlier reduction stages. One would expect, on the basis of biface populations for stages 1 and 2, that suitable numbers of stage 3 forms would be represented in the assemblage by either whole or fractured entries. This is not the case, as only ten stage 3 forms were recorded for the entire quarry zone assemblage, and these were all either fragmented, faulted by poor length-width-thickness ratios, or flawed with nonremovable mass buildups (Photograph 20). Furthermore, this biface category was only reported from zones within the quarry sites where evidence of locational patternings of specialized, multiple-activity tool assemblages were recognized. This suggests that stage 3 biface forms were not directly associated with quarry activities per se. In addition, stage 3, 4, and 5 bifaces would likely be curated by the aboriginal craftsmen and portaged to other places to be further refined or used for other undesignated resource extractive activities.

Reference has been made above and in Sections III and V to areas within the float lithic resource quarry zones where evidence of multiple use, or patterns reflecting multiple activities of both extractive and maintenance processes, has been recorded. This pattern was first noticed when site 4-SBr-4204 was discovered (Kaldenberg 1980:personal communication) and posited on the basis of subsequent results of intensive survey (Davis, Eckhardt

Photograph 17. Multiple flake removal scars and development of a lanceolate form are visible in this photograph of a stage 2 biface. Cortex still remains on the upper surface of the artifact. This form is very similar to Old World Acheulian hand axes.

Photograph 18. This photograph illustrates an ovate form of stage 2 biface reduction. The fissure across the surface of the artifact formed naturally within the lithic material or developed during the reduction process. The biface is lightly incorporated in a moderately to well-developed desert pavement within the Bow Willow Wash area.



Photograph 19. A close-up of the working edge of a unifacially retouched bifacial tool recorded from site SBr-4249 is shown in this photograph. The tool form was apparently developed from a stage 2 biface, where the basal (proximal end) region has undergone further refinement and modification.

Photograph 20. This stage 3 chalcedony biface was recovered from site SBr-4249. The close-up details the overlapping flaking pattern and the development of mass brought about by premature flake terminations which step and truncate rather than carry across the face to reduce total biface thickness.

and Hatley 1981:85, Figures 9 and 26). Large assemblages of finished tool-type artifacts were observed on alluvial fan surfaces closest to the stream channel, while zones further removed exhibited less refined and smaller assortments of cultural debris. On the basis of these and other observations, theoretical orientations for additional documentation were proposed (Eckhardt and Hatley 1981).

Mapping, documentation, and recording procedures performed during the current study have refined and partially substantiated the earlier claims for multiple-use areas in conjunction with these major quarry zones. Analysis shows that divide areas within the moderately dissected supporting alluvial fan surfaces contain a broad array of artifact forms and features in varying amounts and ratios. On the evidence of the presence of particular artifacts and features neither necessary nor sufficient to quarry resource extractive tasks, other behavioral activities must be inferred. However, problems of context, rates of deposition, and temporal sequence must be resolved--or held constant--in order that more confident interpretation of patterns of activity may be deduced.

Features recorded within or adjacent to each of the three major float lithic quarry zones include rock rings and possible fire hearths. In addition, two rock shelters were inspected in the vicinity of the Bow Willow Wash zone, and a third possible shelter was reported adjacent to the Assembly Area during previous fieldwork (Davis, Eckhardt and Hatley 1981:101-106). These features are not known to be necessary for extractive quarry tasks, but rather may be construed as evidence of maintenance activities. Maintenance tasks have been defined (in part) as preparation and distribution of foods and fuels already in hand (Binford and Binford 1969:71).

Rock rings within the study areas vary in diameter from slightly less than one meter to as much as 2.8 meters. Photograph 21 shows a rock ring of the smaller dimension, recorded in the Bow Willow Wash area (Map H, Appendix A). The clasts arranged in ring-like fashion are well embedded in the supporting alluvial surface. Most of the divide area on this portion of the alluvial fan is covered by small angular gravels and liberally coated with larger granitic cobbles. Light-density flake scatters were reported adjacent to this rock feature, but no artifacts were recorded within the ring itself.

Similar features were reported in the Assembly zone (4-SBr-4751; see Figure 25) and also within the Silver Lake Road quarry area (Photograph 22), although both are larger than the previous example. Even though disturbed by vehicular tracks through its central aspect, the rock feature shown in Photograph 22 remains in fair condition. Cobbles used for the perimeter lie primarily on the surface, and strongly formed desert pavement is

Photograph 21. Recorded in the Bow Willow Wash area, the primary rock ring feature in this photograph is approximately one meter in diameter. The stone elements are well embedded in the surrounding desert pavement. Additional rock configurations are also visible in association with this feature.

Photograph 22. Depicted in this photograph is a rock ring feature recorded in the Silver Lake Road area (4-SBr-4747). Although disturbed by military vehicular travel, the ring is in relatively good condition. Most of the stone elements lie on the surface of a well-developed desert pavement.

Photograph 23. Shown in this photograph is a rock configuration recorded as a possible fire hearth. As discussed in the text, questions remain regarding the origin of such features (e.g., natural occurrence, deflated cairn, or fire hearth). The scale is twenty-five centimeters.

noticeable in areas undisturbed by the vehicle tracks. No artifacts were found within this rock feature, although flaked lithic scatters were noted nearby slightly south and to the east (Map C, Appendix A).

Rock ring features are widely found throughout the American Southwest, as well as many other locations (Hatley 1982:24, 46). Malcolm Rogers, who recorded large numbers of these features in the Mojave and Colorado deserts, thought they were associated with differing temporal and cultural affiliations, including both the Paleo-Indian and Late Prehistoric periods (Rogers n.d.:field notes; Rogers et al. 1966). He believed these features were primarily used for habitation, but additional uses have been suggested, to include collecting and harvesting seeds (Begole 1976:17; Tinsdale 1974:95) and as a point of focus for vision quests (Bowen 1976:40-41; Davis, Brown and Nichols 1980:Figures X-7). Differing configurations and demographic locations were felt by Rogers to be temporally sensitive elements (Rogers n.d.:field notes; cf. Hatley 1982), thereby enabling various cultural affiliation assignments (Figure 28). Factors such as presence or absence of boulder rims, maximum diameter, entryway orientation (when present), form, occurrence of associated artifactual materials, and isolated finds versus multiple feature configurations were temporally sensitive (Rogers n.d.:field notes). Unfortunately, Rogers never refined this chronological formula, and recent efforts to apply these data to rock ring features in the Mojave River region were primarily unsuccessful (Hatley 1982).

Possible fire hearths noted during the current study were reported only in the Bow Willow Wash area (Maps F and J, Appendix A). As may be seen in Photograph 23, there is potential for these features to be either natural occurrences, fire hearths, or deflated prehistoric cairns (see Figure 28). Granitic samples from a single potential hearth feature in the Bow Willow area (Map J, Appendix A) were selected for thermoluminescence analysis in hopes of addressing the question of hearth versus cairn or natural occurrence. If the material sample proved to be hearthstone, relative dating of the feature was the next important task. An ongoing project dealing with thermoluminescence techniques was identified (Sutton 1980), but new evidence discloses that the process will not result in accurate assessments (Dean 1982:personal communication). For the moment, this line of inquiry cannot be used to validate feature type or provide any temporal framework.

Rock shelters inspected in the vicinity of the Bow Willow Wash area include Locus SAD-1 (discussed in Section V) and another in the granitic highlands north of the wash--temporarily recorded as WTE-21. Locus SAD-1 (Photographs 24 and 25) was first reported during initial survey (Davis, Eckhardt and Hatley 1981:97) and was subjected to surface collection and test

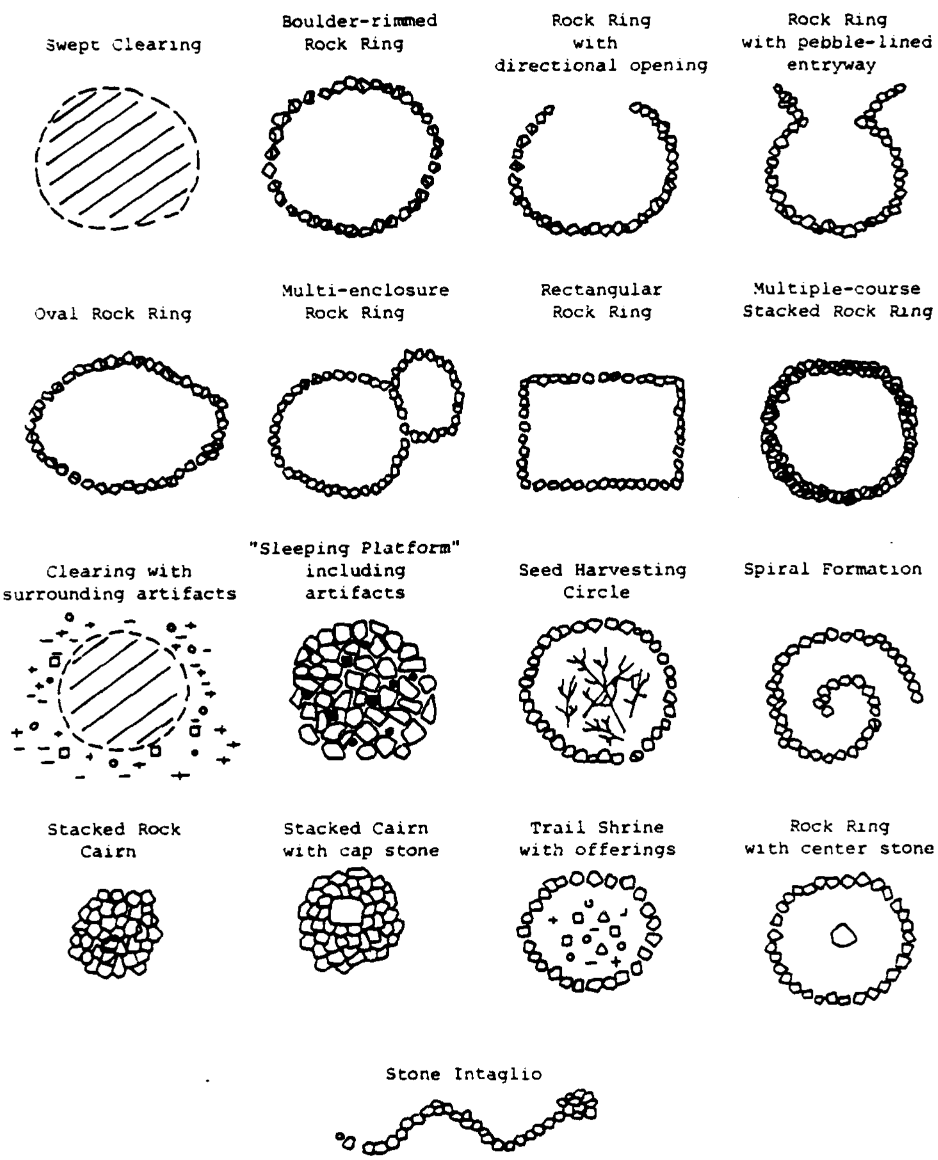


Figure 28

Various rock ring configurations noted at numerous localities in the southwestern deserts are illustrated above. See Rogers et al. (1966) for additional stone feature forms.

Photograph 24. This photograph illustrates a portion of the rock shelter at Locus SAD-1. The test unit excavated during the current project can be seen in the center of the photograph. Military impacts and debris common to the area can also be seen--a practice tank or mortar round in the center foreground and marks from target practice with tank rounds on the face of the rock shelter.

Photograph 25. This view of the in-progress subsurface test at Locus SAD-1 shows the test unit at the thirty-centimeter level. In the central portion of the unit is a massive boulder which hindered subsurface excavation. A charcoal lens is visible along the northeast sidewall (upper portion of photograph).

Photograph 26. The rock shelter recorded during the current investigation as WTE-21 is shown in this photograph. Midden build-up and associated artifacts are present both under and in front of the shelter overhang.

excavation techniques during the current project. Subsurface cultural materials were identified to a depth of fifty centimeters and include a temporally sensitive projectile point (thirty to forty centimeters) from the Late Prehistoric period (ca. 1500 years B.P. to Present). The shelter in the granitic highlands identified as WTE-21 (Photograph 26) was only briefly inspected. Biface tool fragments, flakes, utilized flakes, a hammerstone, one metate fragment, and numerous burnt bone and charcoal fragments were noted near and under an overhang at more than 1000 meters above mean sea level. Affected surface area measures roughly ten by seven meters. Considering the preserved state of burned faunal and floral remains at the surface, this site may be another recent cultural manifestation (ca. 1500 years B.P. to Present), although dry cave sites elsewhere in the Mojave and Great Basin regions have shown great antiquity (Harrington 1933; Haury 1950; Smith 1957, 1963), and the absence of temporally diagnostic artifacts leaves the issue of age open to question.

Scant evidence from these two shelters suggests their possible use as temporary base camps. If inferences of habitation areas or fire hearths for rock rings and rock features hold true, some evidence of base camp operations may be present on the alluvial fan surfaces as well. However, serious questions are unresolved about the temporal relationship between shelters and features discussed above and the preponderance of cultural residues noted throughout the float lithic source quarry areas.

In presenting a generalized settlement model for technologically simple societies, the Binfords' focus on hunter gatherers (Binford and Binford 1969). Their analyses are particularly useful here, as even the most recent, protohistoric indigenous populations using the northwestern Mojave Desert region fall within this level of cultural development (Section II). Three types of sites or encampments have been suggested, dealing with extractive and maintenance activities for hunter-gatherer groups: work camps (extractive), transient camps (minimal evidence of maintenance activities), and base camps (maintenance). Regarding the definition of these activity sets and their manifestation in the archaeological record, the argument is presented that:

> In technologically simple societies we can distinguish two broad classes of activities: Extraction and maintenance. Extraction involves the direct procurement of foods, fuels, and raw materials for tools. Maintenance activities consist in the preparation and distribution of foods and fuels already on hand and in the processing of raw materials into tools (Binford and Binford 1969:71).

Within this paradigm, the implication is that composition of feature and tool assemblages at various locations will be a function

of both the kind of tasks performed and the size and composition of the group performing them (Binford and Binford 1969:70).

Looking again to the float lithic source quarry zones outstretched on the exposed alluvial surfaces, analysis of the entire pattern becomes a point of focus (Maps B-N, Appendix A), and rates of cultural deposition and temporal sequence provide the matrix for refined interpretation.

Examination of the Silver Lake Road quarry area (Maps B-E, Appendix A) shows that perhaps two major activity sets were performed in the region, one set dealing with quarry resource extraction and the other the working of other resource materials with certain tools manufactured from the local lithic resource. Most artifacts in this region are biface flaked tools (Table 9) of locally derived rock (primarily chalcedony in material type). Biface flaked tools have often been thought to be used for chopping, gouging (or scraping), wedging, or sawing (Bryan 1950; Davis, Brott and Weide 1969), although insufficient analysis of edge wear and replicative experimentation have been conducted to validate these propositions (cf. Crabtree and Davis 1968; Jackson 1977; Brink 1978). Hammerstones and a wide array of quarry refuse were also noted in the Silver Lake Road quarry area, as reported previously (Hanna et al. 1981:175-183) and discussed earlier (above and Section V). This admixture of working tools and quarry materials was suggested by Bryan (1950:3) to represent indigenous industrial sites or factories for the processing of wood and bone. Work by Crabtree and Davis experimenting with woodworking tools tends to support the inference of Bryan. As reported:

> Working of wood quickly consumes stone tools; for this reason, much roughing-out of wooden gear may have been done by aborginies at quarry workshops, near an abundance of material for primary tools (Crabtree and Davis 1968:428).

The general pattern of cultural refuse in the Silver Lake Road quarry area includes distinct flake lithic scatters with no objective work pieces, primary and secondary core reduction stations, biface flaked tools and bifaces in reduction stages 1 through 3 (both within and without flake lithic scatters), outlying modified flake-based tools, scraper-like devices and one planate tool (with and without associated flake lithic scatters), and two fragmented projectile points. These residues occur in two primary foci (4-SBr-4515 and -4516), one of which (4-SBr-4516) has been extremely disturbed by military vehicular and pedestrian travel and construction and use of a stockade training facility (Map E, Appendix A).

The Silver Lake Road quarry area is seen as containing evidence of both extractive and maintenance activity, with the

primary tasks inferred as flake stone resource extraction, flake stone tool manufacture, and the processing of other material resources with flake stone tools. The patterns and material assemblage suggest work camps and transient encampments. However, the nature of temporal relationships within and between these cultural manifestations is seriously clouded.

Temporally diagnostic artifact forms within or adjacent to the Silver Lake Road float lithic resource areas are limited--two groundstone platforms (see Table 6) and two fragmented stage 4 bifaces (distal ends) which might support a variety of chronologic determinations for any period between 6000 years B.P. to Present. The nature of the rate (or rates) of deposition of the material assemblage, which would likely help clarify temporal sequence and inform about the size and composition of the group (or groups) responsible for them, is equally difficult to interpret. Discards and refuse from past human activity at these sites are limited to only impervious elements, and among these are no artifact types or forms of extremely sensitive diagnostic character. Any stains and organic residues from past human occupation and use of particular localities within the site have long since dissipated, and localities of artifact concentration are presently found coterminous with surface zones where soil deflation and desert pavement formation prevail. Attempts to determine duration of occupation, whether the source was repetitively used, and if so by whom, how many, and when, are not easily approached. It is unfortunate that, from the present level of understanding, rates of deposition and any confident perspective of temporal sequence remain elusive.

The Assembly Area float lithic resource zone (Maps K-N, Appendix A) presents a somewhat similar pattern to that noted for the Silver Lake Road area. However, data for inferring temporal sequence are more readily available and evidence with reference to task-specific activities and the question of group composition is present. For general discussion and point of reference, the material, assemblage and contextual data recorded for the Assembly Area portray both extractive and maintenance activities, with numerous workshops and encampments or base camps in distinct locations. These are interpreted as flake stone resource extraction areas, processing sites for both flake stone reduction and preparation of (or construction from) other natural resources, small group encampment zones, and (seemingly) more complex base camps.

The Assembly Area resources have been the focus of previous assessments (Davis, Eckhardt and Hatley 1981; Hanna et al. 1981) and are presently undergoing additional research (Skinner n.d.:manuscript in preparation). Current examination of this zone has focused on site 4-SBr-4249, although available data from other works are applied in this analysis as well. Questions raised in presentation of the Silver Lake Road area about rates

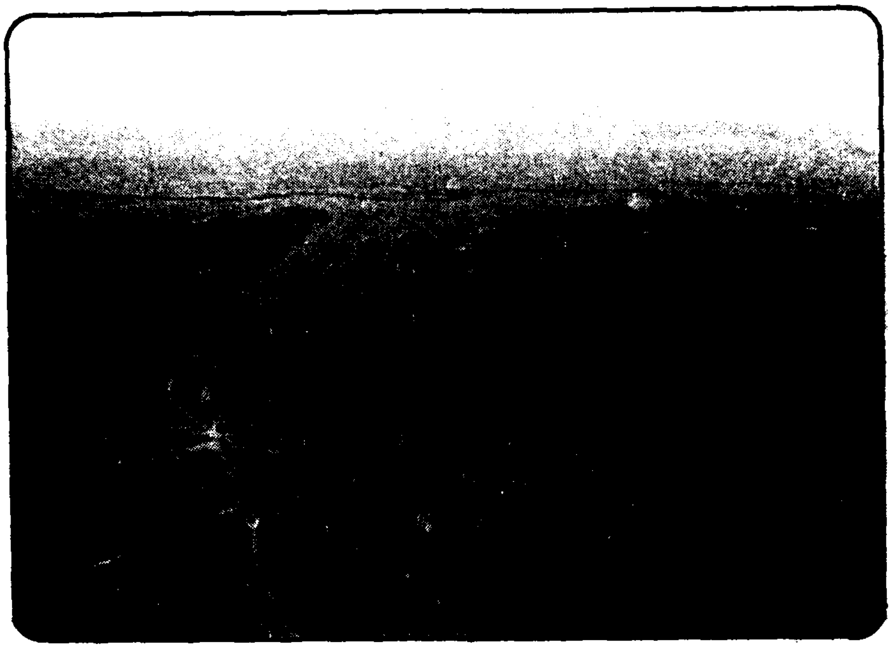
of deposition and temporal sequence are returned to in the following discussion.

The northern one-half of 4-SBr-4249 (Maps K and L, Appendix A) provides enticing information about early periods in the prehistory of the northern Mojave Desert. Unlike the pattern of cultural resource deposits in the Silver Lake Road area (e.g., 4-SBr-4515, Maps B-D, Appendix A), the depositions of cultural refuse in this zone are dispersed over a larger area. Areas of artifact concentration can be more readily distinguished and variation between localities--with reference to artifact types, spatial patterning, and micro-environments--supports inferences of task-specific activities and allows some interpretation about past human behavior.

In the northern extreme of 4-SBr-4249 (Photograph 27), localities are distinguished by the dearth of formal or informal tool types (Map K, Appendix A). Light- to medium-density flake scatters are present with roughly equal numbers of associated primary and secondary core reduction stations. The few bifaces in this region are associated with flake scatter and core reductions. A single scraper-like device was also reported in association with flake scatter and secondary core reduction refuse. Much of this zone is undergoing modern alluviation and the older fan sediments are being dissected and overrun. Cultural debris is noticeable only on the older remnant surfaces where divides are still present near the major pluvial channel of Bow Willow Wash. The general pattern suggests work camps and activity areas where lithic resources were subjected to testing or inspection, some being discarded while others were reduced to more useful forms (cores and bifaces) from which some processing--stone tool manufacture--took place.

Artifacts in this area (Map K, Appendix A) show medium rates of patination and many were well embedded in supporting pavement surfaces. However, environmental factors are very active in this zone and displacement, burial, and reworking of artifacts and their associated locations is a problem. The distinctive pattern of this area--discrete, segregated localities--is probably more a function of transformation than meaningful cultural behavior. Nonetheless, the absence of formal and informal tool categories traditionally representating extraction or processing of other than lithic resources stresses behavior associated with flake stone lithic reduction. The total tool inventory suggests that limited groups--individuals or small work parties--left the deposit.

Continuing southeastward, the remainder of the northern one-half of site 4-SBr-4249 (Map L, Appendix A) contains evidence of encampment and maintenance activities, along with other materials suggesting continuation of the float lithic resource extractive tasks noted to the north. Photographs 28 and 29 show the



Photograph 27: This photograph is an aerial view toward the east of site 4-SBr-4249. Prominent topographic features include Bow Willow Wash and both recent and older dissected alluvial fans. The S-3/S-2 area discussed in the text is visible in the upper central portion of the photograph just right of Bow Willow Wash where it bends toward the south.

landform and general erosion patterns of this zone. Previous fieldwork conducted here includes preliminary survey and accurate mapping of a single location (Davis, Eckhardt and Hatley 1981:124-128, Figure 27).

The area referenced as S-2 and S-3 on Map L (Appendix A) contains the greatest variety of artifact forms in the 4-SBr-4249 area and is considered a maintenance, base camp zone. At least two temporally significant stage 5 bifaces (projectiles) were recovered (Photographs 30 and 31). These are attributable to the Paleo-Indian Tradition (see Table 1) that Warren and others called the Lake Mojave Period (Warren and Ranere 1968; Warren, Knack and von Till Warren 1980). Both bifaces exhibit fluted characters at the basal region, and similar examples have been noted with the Lake Mojave Complex (Warren and Ranere 1968), in the Lake China Basin (Davis et al. 1978), elsewhere in the Assembly Area (Skinner n.d.:manuscript in preparation), and throughout diverse locations in the Mojave Desert region (Rogers 1939; Tuohy 1974). The style is most likely from the earliest post-Pleistocene periods, roughly 10,000 years B.P.

In addition to finalized biface projectile forms, the S-3/S-2 locality contains numerous flake scatters and core reduction stations, including bifaces in various states of reduction (see Photograph 20). Modified flake-based tools and biface flaked tools occur in smaller number (Map L, Appendix A), although with the addition of typological blades, these work tool categories are fairly apparent.

Evidence supporting refined inference of maintenance activity includes two stage 4 biface (projectile) forms. One complete specimen (Photograph 32) was previously misinterpreted as a completed projectile form reminiscent of late San Dieguito sequences (Davis, Eckhardt and Hatley 1981). This biface most probably represents a discarded work piece from the fluting traditions noted earlier, as unfinished basal aspects and surface irregularities coupled with a poor index in width-thickness ratio point to an incompleted process in the manufacture of fluted points (Reiner 1981:personal communication).

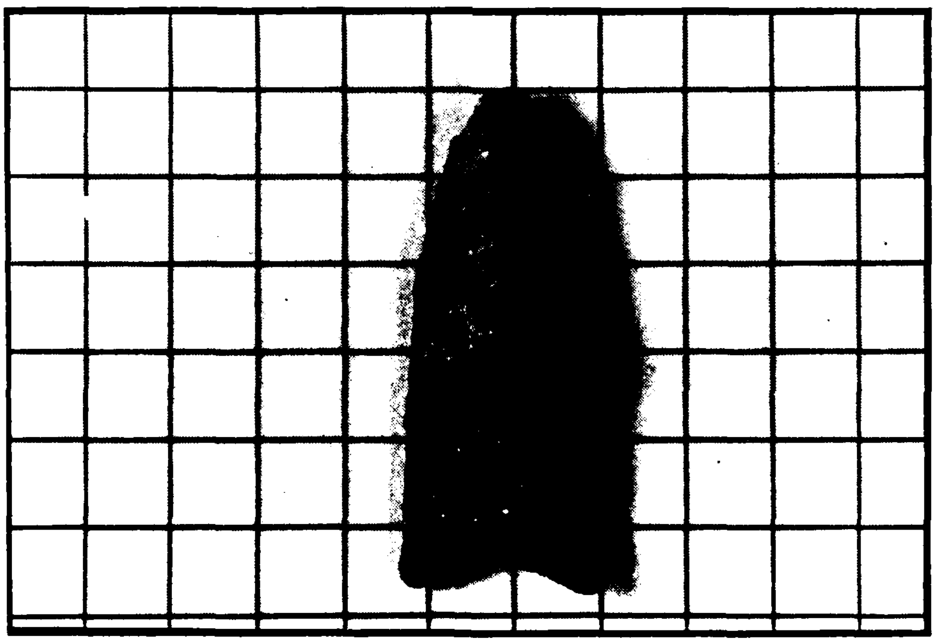
The specimen in Photograph 33 is also a stage 4 form, but unfortunately is incomplete and not well suited for chronometric dating. This biface appears to have suffered mesial fracture as a result of end-shock, a fracture frequently associated with refined stages of reduction. An exceptional width-thickness ratio is observed on this work piece, and its fracture is therefore more accountable to lithic reduction techniques than to postulates suggesting damage through use.

The total assemblage reported for the S-3/S-2 area is somewhat unique owing to its presence on low-lying, relatively flat alluvial surfaces. The majority of artifacts appear well

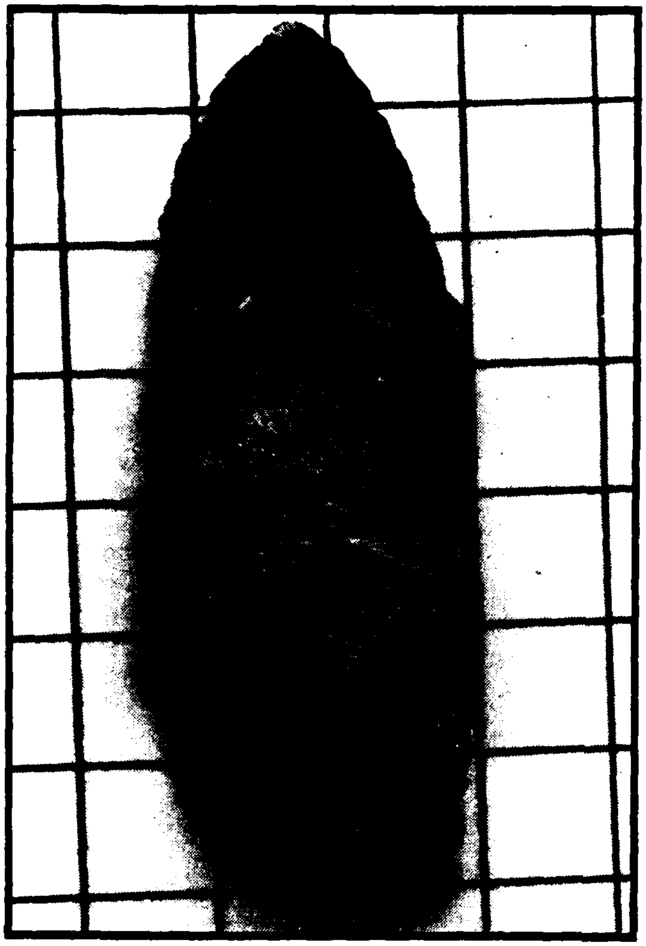
Photograph 28: This photograph is a lower altitude aerial view toward the northeast of the S-3/S-2 area, which is situated on the elongated terrace in the upper central aspect of the photo. This terrace, as well as those in the lower portion of the photograph, are heavily dissected alluvial fan remnants dating to between 17,000 and 20,000 years B.P. The lighter patches are vertically uplifted ash beds which are older than the lacustrine beds in the northern end of Bow Willow Wash. Evidence of active alluviation is visible along the left of the photograph.

Photograph 29: *Looking* southwesterly, this photograph is another aerial view of the S-3/S-2 site area. Bow Willow Wash is visible in the lower portion of the photograph. The darker appearing topography in the upper left area is a more stable fan surface of a similar age as the fan to the right upon which S-3/S-2 is situated. Modern alluviation is present in the upper portion of the photo.

Photograph 30: This stage 5 biface (projectile) fragment was recovered from 4-SBr-4249. Note the two fluting scars evident along the basal area; the artifact has been bifacially fluted, although only one face is shown. The fragment has steep, parallel lateral edges with evidence of retouch and straigtening. The mesial fracture was undoubtedly caused by "end-shock phenomena." A stage 4 flake scar is still present in the central portion of the artifact just below the fracture. (1 grid square = 1 cm)



Photograph 31: Similar in form as the above fragment, this artifact is also a stage 5 biface recovered from 4-SBr-4249. It has been bifacially fluted and the almost-parallel edges have been retouched and straightened. Collateral pressure flaking is evident. (1 grid square = 1 cm)



Photograph 32: Recovered from 4-SBr-4249, this artifact is a stage 4 biface. Although thin in width, the artifact is robust in thickness, as seen in the central portion. This loss of optimal width-thickness ratio, in conjunction with the presence of step fractures and an available platform along the right lateral edge, supports the inference of artifact discard. Basal preparation, possibly in preparation for removal of a flute, is incomplete. (1 grid square = 1 cm)

Photograph 33: This photograph illustrates another stage 4 biface recovered from 4-SBr-4249. The arris ridge resulting from stage 4 flake removals is visible in the lower-central aspect of the artifact. The right lateral edge is burin-like in form, and there is evidence of collateral flaking. The dark spots toward the tip are lichen. (1 grid square = 1 cm)

embedded, although significant numbers are also found to lie atop both sandy and pavemented surfaces. While the condition of these resources has been modified both by environmental and human agencies since their original deposition, the evidence suggests that this locality is in a high state of preservation (see Davis, Eckhardt and Hatley 1981:128, Figure 27).

To the south, cultural resources in the Assembly Area take on a different pattern. Landform changes from low-lying flats to higher divides, with fairly developed incisions separating the now-terraced fan surfaces along Bow Willow Wash. In this zone (Map L (southern one-third), M, and N, Appendix A) greater numbers of informal and formal tool types occur, and the pattern suggests processing of immediately available resources--both lithic and other natural materials. Rates of embedment were recorded for this region, but analysis shows a random pattern. Degree of slope and artifact volume may account for this phenomenon, as the surfaces of the fan are apparently still changing. A large number of the cultural materials were noted which were more than half buried by unconsolidated gravels and clasts (Photograph 34).

Tools recorded for this region include hammerstones, biface flaked tools, modified flakes, scraper-like devices, and planate tools. A number of items in the biface flake tool category were identified as wedges, and spokeshaves were also reported. Unfortunately, these categories rest on field assessments alone, as the objective items were not recovered for further detailed analysis. However, one refined tool form was recovered from the region, a scraper-like device from a medium flake scatter in the vicinity of Q-6 (Map M, Appendix A). This item is a flake-based unifacial tool (Photograph 35) of fine-grained felsite with medium patination and well-developed manganese stain. The ventral surface has remnants of bulbar scar and fissures on an otherwise flat, slightly concave plane. Most evidence of the original platform was removed in the course of tool manufacture, and the entire perimeter was substantially trimmed. On the dorsal side, cortical surfaces attest to the tool's manufacture from a primary flake (Photograph 36). Larger flake scars from thinning are bounded by smaller, refined flake scars from subsequent removals. Around 90 percent of the perimeter (excepting the extreme proximal end) a third row of scars is observable, perhaps the final flake removals in tool manufacture (Photograph 37). Evidence of use consists of minute fractures, rounding, and polish around the perimeter of the tool's distal (working) end, flattening of curvature on the leading end in this region (Photographs 35 and 36), and smoothing and polishing on the high arris ridge along the dorsal surface (Photograph 36).

Recent experimental work with flake stone tools and their use has been conducted by numerous researchers, some of whom have focused on end-scraping tools (Brink 1978). Devices similar to

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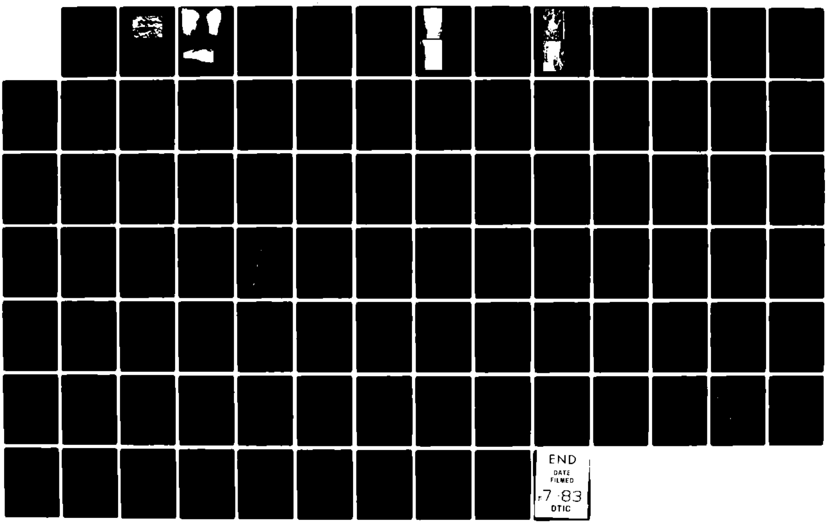
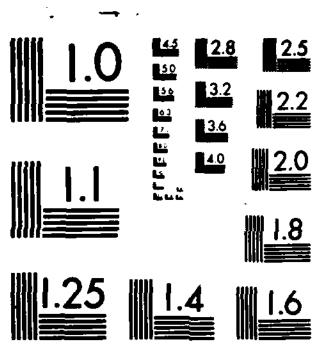
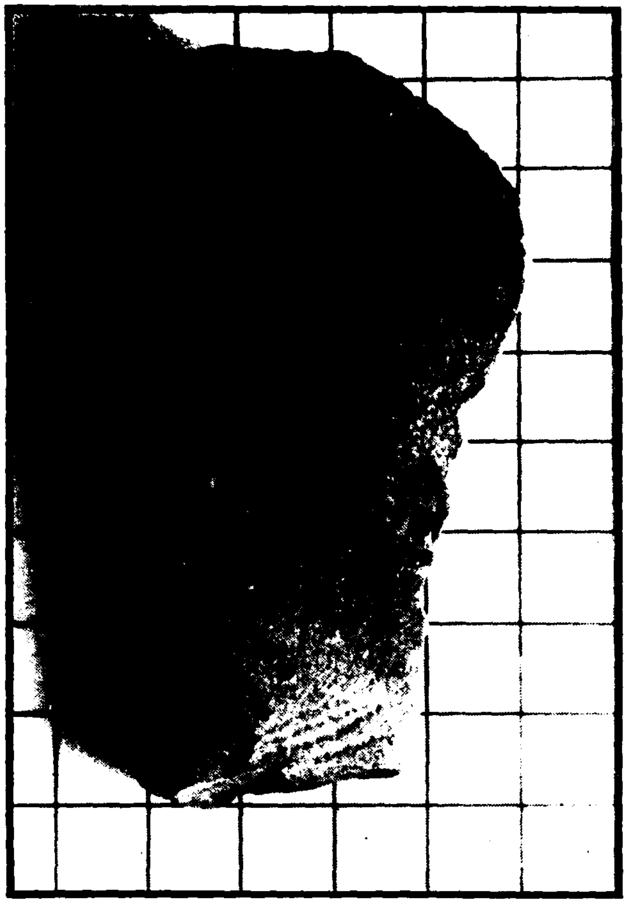


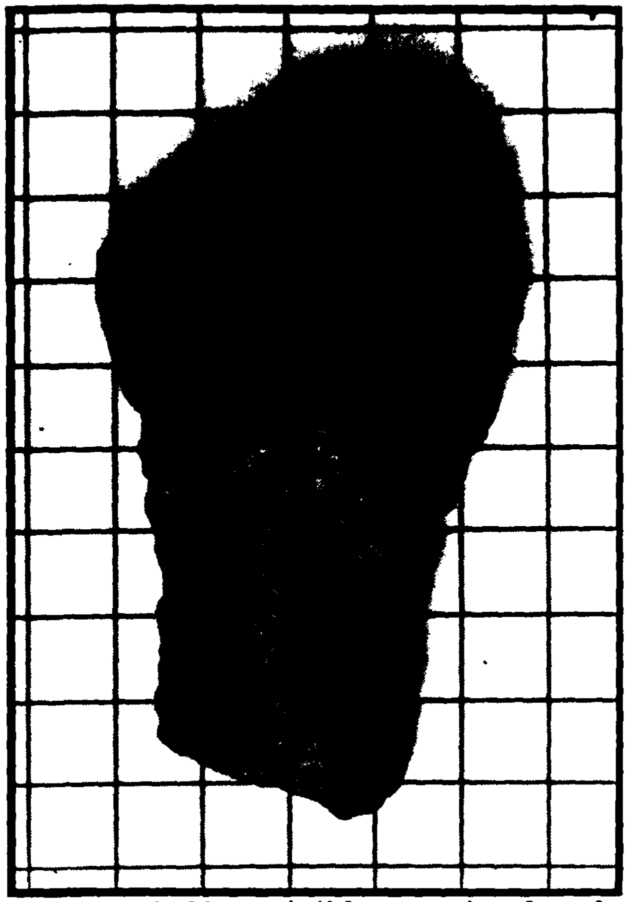


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

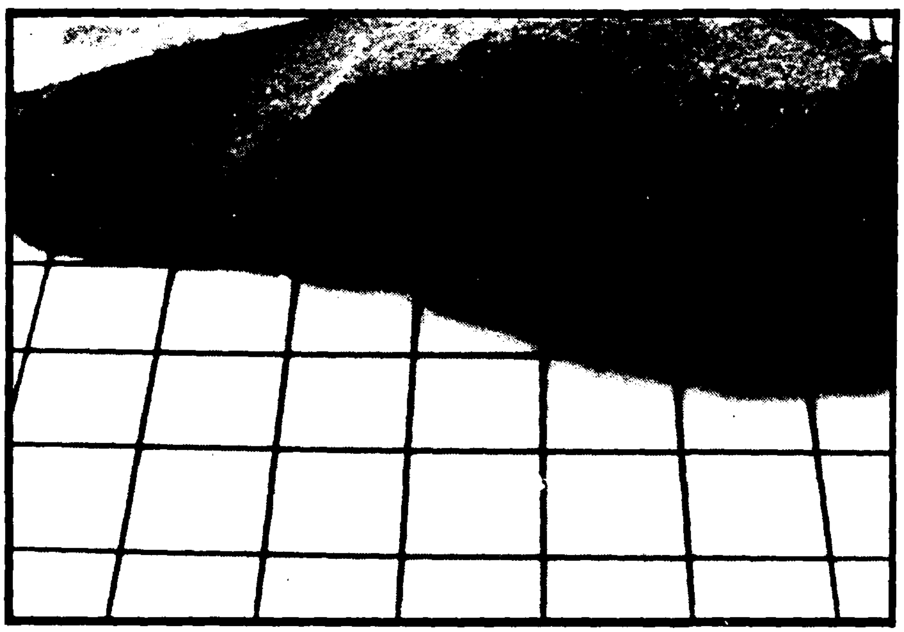
Photograph 34: Illustrated in this photograph is a macro-flake 60 percent buried by modern alluvial forces and aeolian erosion. The surrounding, heavily patinated desert pavement consists of small gravels, medium clasts, and larger cobbles all interspersed.



Photograph 35: The artifact illustrated in this photograph is a unifacial, flake-based tool recovered from 4-SBr-4249. A remnant of the striking platform is visible to the lower left; the original platform may have been removed during tool manufacture. Several generally straightened edges are apparent along the leading (upper) edge. (1 grid square = 1 cm)



Photograph 36: Visible on the dorsal face of the unifacial tool is a prominent arris ridgeline, along which is evidence of rounding and polishing. An area of cortex is also present.



Photograph 37: A cross section view illustrates the unifacial retouch pattern on the tool along the lateral edge. Previous flake scars are also visible along the proximal edges--these thinning flakes may have been removed to facilitate hafting.

the one in hand have been found to be very useful when held or hafted so as to draw the tool toward the worker, leading with the ventral face (Brink 1978:Figure 1). Variable damage and use wear accrue to the work piece depending on the consistency of material being worked (Brink 1978:61-113). For dense materials, hafting of the work piece increases available pressure and leverage between the user and the material being worked. Rounding and polishing, as opposed to micro-flake wear, is the prevalent form of use wear, as observed in work with wood, bone, and hide (Brink 1978:116).

Artifacts similar to the end-scraper recovered from the Assembly Area have been recorded from elsewhere in the Mojave Desert region (Simpson 1956), and a specimen reported by Moriarty (1962:149-152) was recovered from a La Jolla midden (ca. 4000 to 3000 B.P.) along the southern California coast. Hafting was found on the earlier reported specimen, supporting the experimental evidence and ethnographic inference of Brink (1978).

Evidence of flake lithic resource extraction and stone tool manufacture is also recurrent in the higher elevations of the Assembly Area (Maps L-N, Appendix A). Cores of every provisional category are identified for this region, as are bifaces (stages 1-3), hammerstones, and medium-to-dense flake lithic scatters. Of interest in the patterns presented here, the greater number of typological blades reported for the area are found in association with secondary core reductions. In addition, a high number of biface stages 1 and 2 forms were recorded, while only a single stage 3 form was found.

One interpretation of this region in the Assembly Area float lithic resource zone is that the cultural refuse shows intensive work camp activities associated with quarrying, lithic reduction (e.g., testing, inspecting, reducing), stone tool manufacture, and the processing or utilization of other natural resources. The rate of deposition remains unknown and the patterning of individual localities cannot be interpreted without thorough statistical analysis. Except for the few temporally sensitive artifact forms, most materials are not attributable to particular periods or culture complexes from the prehistoric past. However, it is assumed that the Assembly Area resource areas were the focus of some human activity at least twice in the past ten thousand or so years: in the Paleo-Indian period and again in the Early Prehistoric (see Table 1).

Across Bow Willow Wash from the higher elevations (Map M, Appendix A), another zone of potential base camp activity was observed. This area was subject to intensive pedestrian survey, and a series of dense lithic scatters with numerous tools and distinct core reduction stations was recorded as 4-SBr-4746 (described in Section V). The material assemblage includes many forms similar to those westward along the high divides and two

which had not been noted previously: groundstone platforms and handstones (see Figure 20). Four slab metate fragments (both unifacially and bifacially ground), one bifacial mano, and one shouldered mano fragment were found. No pottery or other Late Prehistoric materials were observed (e.g., temporally sensitive projectile points, mortar and pestle milling equipment). The site appears to be a base camp--perhaps extended family in size and used seasonally. Sites of this type noted in Pinto Basin (Campbell and Campbell 1935) were described by Wallace as located along the banks of a pluvial watercourse, with artifacts--most abundant being the Pinto projectile points--consisting entirely of flaked stone and groundstone, with numerous rough service tools in evidence (Wallace 1962:175). This lends added weight to Early Prehistoric occupation and use of this float lithic quarry area, refining the potential for greater accuracy of interpretation.

Examination of the Bow Willow Wash float lithic source quarry zone (site 4-SBr-4204, Maps F-J, Appendix A) provides an opportunity to develop more fully the questions raised and refined through earlier discussion of the resources reported in the Assembly and Silver Lake Road areas. A pattern emerges from the combined data suggesting long-term, seasonally patterned use of the resources in these areas for perhaps the last 10,000 to 12,000 years. As this inference leans on several presumptions involving availability of basic subsistence resources other than lithic material for stone tool manufacture, evidence of paleoclimatic conditions and its presumed effect in changing site environments is considered.

The Bow Willow float lithic quarry zone was first reported by Kaldenberg (1980d:site form, 4-SBr-4204) after brief reconnaissance in 1980. It was later intensively surveyed during reconnaissance of Assembly and Defense areas in the Live Fire Maneuver Range (Davis, Eckhardt and Hatley 1981:84-100, 141-149). At that time the Bow Willow region had an estimated occupation of between 7500 and 10,500 years B.P. The presumed cultural association was with the San Dieguito phases of the Paleo-Indian tradition (see Table 1).

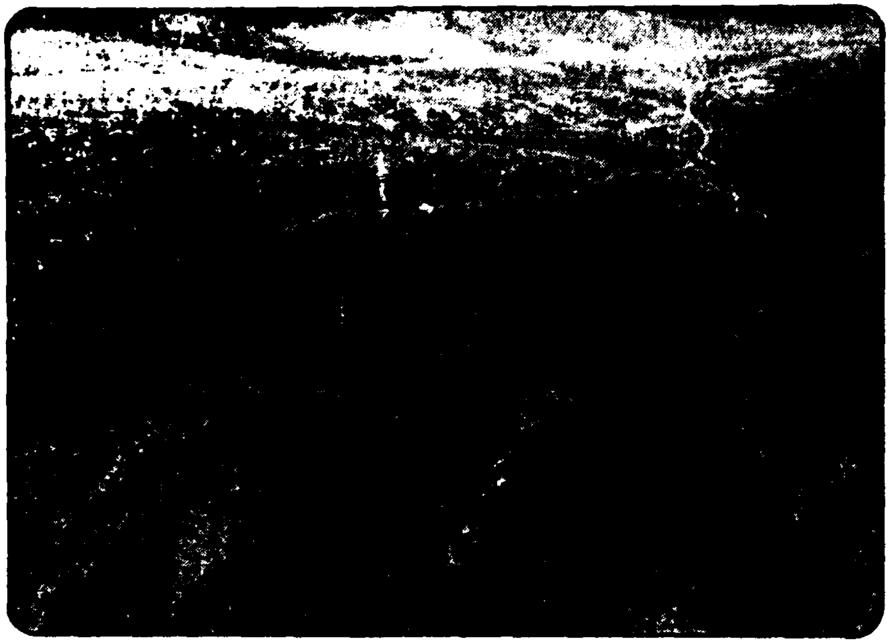
Site 4-SBr-4204 is located at the headland of a major pluvial channel (Photograph 38) draining modern stands of both No Name and Drinkwater lakes (now dry playa lakebeds). Probably created by overflow from Pleistocene high stands of Drinkwater and No Name lakes, this channel flows to the south past the Assembly Area and on toward Red Pass Lake and beyond (Photographs 39 and 27). The lakes drained by Bow Willow are formed in isolated, high elevation basins of some antiquity, and most recent shorelines contain evidence of Late Prehistoric indigenous occupation and use (Davis, Eckhardt and Hatley 1980; Bull 1980, Norwood, Bull and Rosenthal 1981). The material in the Bow Willow area, however, does not consist solely of Late Prehistoric

debris, although test excavation did recover a single projectile of the Desert Side Notch series (see Section V). On the basis of its similarity to artifacts inventoried for the Assembly Area, the assemblage recorded for the Bow Willow zone appears to fit most snugly within the period previously suggested, roughly 3000 to 10,000 years B.P. The extent of Late Prehistoric (ca. 500 years B.P.-Present) or very early (pre-10,000 B.P.) occupation and use of this area cannot be satisfactorily determined on the basis of the information in hand.

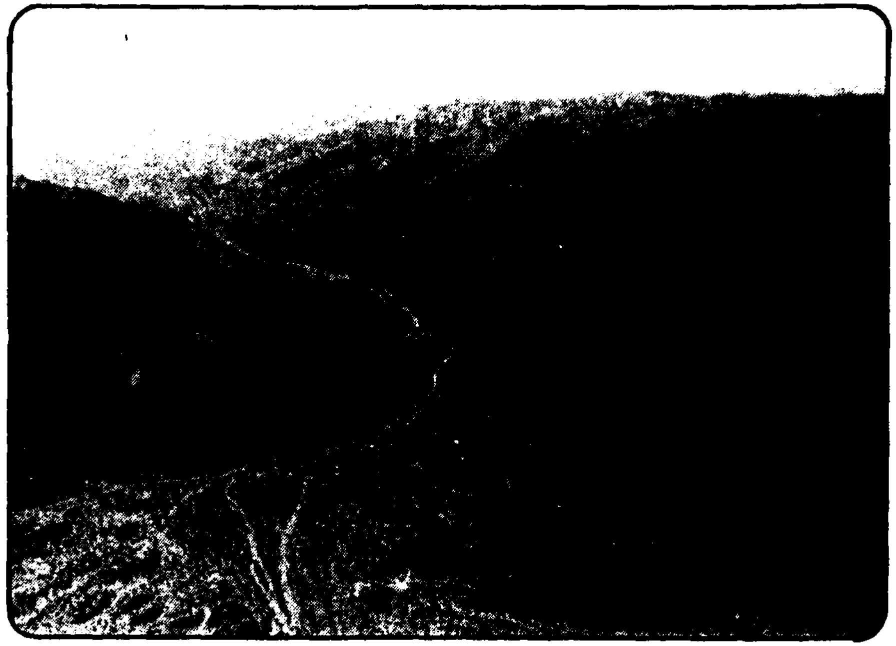
For general discussion and point of reference, the material assemblage and contextual data recorded for Bow Willow reveal numerous workshop and encampment or base camp refuse patterns, interpreted as flake stone resource extraction areas, processing sites for both lithic and floral/faunal resources, small group encampment areas, and zones of possible base camp activity. This evidence is well dispersed over the alluvial divides that grade to the pluvial channel from older, higher fan deposits to the south, and notable concentrations were observed and recorded along the channel proper (Bow Willow Wash), on heavily eroded fan segments marking the boundary of Pleistocene lake stands, and in highlands removed from both the Pleistocene lake margins and the pluvial channel outflow. Because the Bow Willow Wash resources (4-SBr-4204) contain the greatest absolute assemblage recorded for the float lithic quarry zones studied (Table 9), continued analysis of this area will surely bring rich and significant insight to behavior and activity associated with flake stone tool resource extraction in the northwestern Mojave Desert.

Within the northwestern portions of the Bow Willow Wash float lithic quarry zone (Maps F and G, Appendix A), extensive and complex localities of cultural refuse have been reported in several differing physiographic settings (Photographs 38 and 39). For the most part, these residues consist of siliceous clasts exploited locally, although numerous items of felsite, basalt, andesite, and obsidian (in descending frequencies) were also recorded. The broadest spectrum of activity patterns and provisional tool types has been noted here, and important paleoclimatic data were derived from limited geomorphic inspection in this area.

Extensive scatters of flaking refuse and objective pieces (e.g., cores and bifaces) exist in this region, occupying nearly every alluvial divide not currently affected by the modern erosional regime. Refuse from flake lithic reduction is commonly associated with provisional tool forms, although records suggest it is as frequently found apart and distinct from more complex deposits. To consider every locus a work encampment may be misleading, as many localities appear to represent activity areas where lithic resources were subjected to primary reduction--testing or inspection--with some objective pieces being discarded while others were further reduced to more useful forms.



Photograph 38. This aerial view toward tl northeast across portions of site 4-SBr-4204 shows a well-preserved pluvial channel which carried overflow discharge from major high stands of No Name Lake. Lacustrine beds are viewed across the top of the photo and the pluvial channel flows south and eastward in the upper right aspect. Artifacts and activity areas are found on the alluvial divides between modern dissecting drainages which grade toward Bow Willow Wash (lower three-quarters of photo).



Photograph 39. This aerial view toward the east-southeast reveals the relationship between Plio-Pleistocene non-marine deposits and younger, artifact-bearing fan formations along the margin of Bow Willow Wash. Hills to the north (left) of the Bow Willow channel are granitic, while fans and older Plio-Pleistocene deposits (perhaps as much as ten to twenty million years old) are found to the south and west. Heavily dissected fan segments along the outflow zone are partly visible in the extreme lower left of the photo. The older deposits are the source of siliceous clasts used for flake stone tool material and are found along some steep ridges and saddles at higher elevations, within canyons and incisions dissecting the older exposed formations, and reworked into younger fans (ca. 17,000-20,000 years B.P.) which grade toward the granite hills to the north.

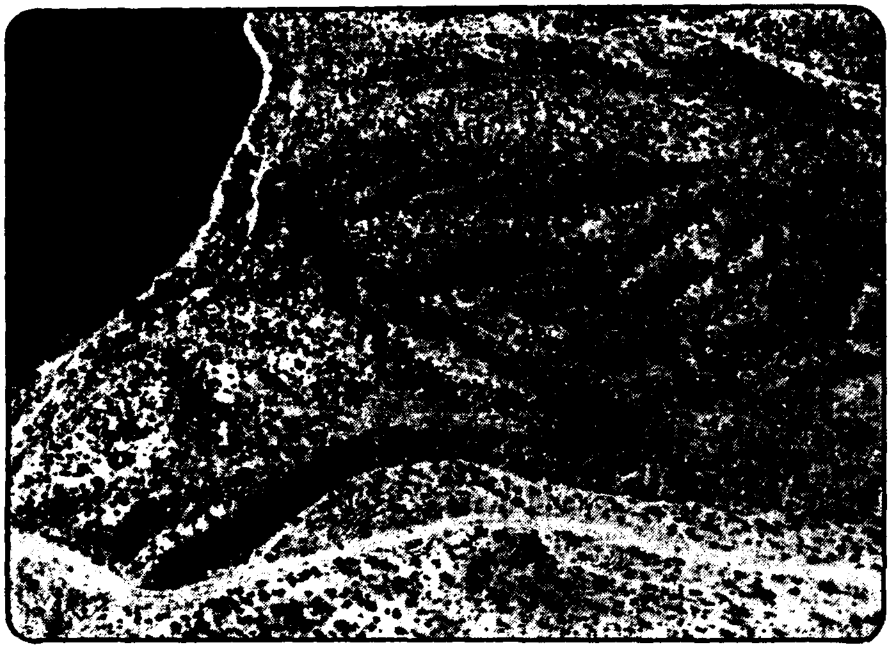
Replicative experimentation has shown that significant deposits of flake stone refuse can result from the primary reduction of only several pounds of lithic resource material in no more than a few hours time.

In addition to activities associated with flake stone resource extraction, refuse patterns in the northwestern portions of the Bow Willow area include many formal and informal tool types, primarily scraper-like devices, but including biface tools, planate tools, modified flake-based tools, typological blades, and hammerstones. These are commonly inferred as representating extraction and processing tools for the manipulation of other natural resources. They consist of basic tool types for scraping, chopping, cutting, and pounding. Use wear was noted for most specimens (typological blades included here on the basis of formal attributes alone), including edge rounding and polishing (cutting and scraping tools), flattening along leading edges (scraping tools), minute step fractures (scraping and chopping tools), edge crushing (chopping and pounding tools), and edge battering. Unfortunately, these observations rest on field assessments alone, as the objective items were not recovered for further detailed analysis.

Rates of embedment and patination are highly variable in this region, depending (at least in part) on micro-environmental variations (cf. Dorn 1982). Relatively flat alluvial divide surfaces develop a protective armor of desert pavement (Photograph 40) that incorporates artifacts into its matrix. Areas of even low-percentage slope tend to bury and/or expose artifacts as surfaces shift and settle under ongoing erosional processes (Photograph 41). Detailed documentation and recovery procedures are necessary if rates of embedment or patination are to be developed for their chronometric values.

To the south and east of the areas discussed above, the cultural resources in the Bow Willow Wash float lithic resource quarry zone are more substantially altered by ongoing erosion (Maps H-J, Appendix A). Here too, rates of artifact embedment and patination covary with micro-environmental shifts in land form. A greater portion of the total site region is undergoing dissection, and increasing zones of active alluviation are displacing older divides where cultural refuse can still be found in provenience.

Artifacts in this southeastern region of Bow Willow Wash are comparable to the assemblages throughout the three major float lithic resource quarry zones, and the pattern they present suggests a continuation of activities associated with lithic procurement and other resource extraction and processing tasks. A relative decrease in the number of formal and informal tool types may be read as either evidence of more particular focus on quarry



Photograph 40. This low-altitude aerial view is of late Pleistocene alluvial fan formations (17,000-20,000 years B.P.) near the outflow of Bow Willow Wash. The pavement viewed in the center of the photograph was subjected to preliminary investigation in 1980 (see Davis, Eckhardt and Hatley 1981:Figure 13) and again during the current study. The darker pavement to the right is the location of control point BW-E. Severe dissection of the Pleistocene alluvial surfaces is visible across the lower quarter of the photo.

Photograph 41. The photograph shows a basalt artifact found on a gradual slope in the BW-E area partially overrun by a loosely incorporated alluvial surface. Roughly 30 percent of the artifact mass rests within the argillic horizon.

resource extractive tasks or depreciation of cultural data owing to continued intensive environmental transformation.

Temporally diagnostic artifacts were not recorded in sufficient numbers in the Bow Willow Wash zone to adequately address questions of contemporaneity or chronologic ordering for the numerous loci and clusters in this float lithic resource quarry region. Of the projectile points recorded in the northwestern area (Map G, Appendix A), only one was complete and capable of being classified with reference to regional typology. This item is a shoulderless Pinto-style projectile with concave base derived from local siliceous material (e.g., chalcedony) and may date from between 7500 to 2000 years before the present (see Table 1; cf. Warren, Knack and von Till Warren 1980). To the southeast (Map J, Appendix A), the Late Prehistoric Period is equally evidenced by the presence of a single Desert Side-notched point found subsurface behind sheltering rocks along the pluvial channel. This point style dates from anywhere between A.D. 1500 up through historic times.

This dearth of temporally sensitive indicators is perplexing, the more so because from the total assemblage inventoried, there are no clear trends in provisional artifact types to dictate whether some or all of the cultural refuse is the result of activities from particular periods in the prehistoric past. Notwithstanding the claims made earlier (Davis, Eckhardt and Hatley 1981:141-149), the chronological ordering of these resources may encompass a greater range of cultural traditions than previously thought.

If the relative dates of occupation and use in this resource area cannot be determined by analyzing the cultural refuse, then close scrutiny of past physical environments may aid in interpreting likely periods or episodes when a greater abundance of resources other than flaked lithic materials would have been available for human exploitation. This approach was briefly considered through geomorphic reconnaissance and assessment along Bow Willow Wash (Section V). The results suggest that paleoenvironmental data available from the Bow Willow zone may have a direct bearing on questions relating to cultural development and change in the northwestern Mojave Desert, particularly for those periods occurring within the past 10,000 years.

The most attractive resource visible today in Bow Willow Wash is an abundant deposit of siliceous clasts. These materials originated in very old Plio-Pleistocene formations which have undergone continuing degradation and are responsible for the late Pleistocene alluvial fan deposits bordering Bow Willow Wash (see Photographs 27-29, 38, and 39). Geomorphic assessment of several localities atop and aside these younger fans was conducted (in part) to obtain a working understanding of their relative antiquity (see Maps F, G, and I, Appendix A). Based on several lines

of evidence, the fan deposits on which the majority of the cultural refuse is found have a maximum age of roughly 17,000-20,000 years before the present (see Section V). These include weakly developed soil horizons and aeolian calcium carbonate influx observed in pits placed atop the fan surfaces, existence of older, underlying Pleistocene (?) fanglomerates examined along naturally exposed profiles, and consideration of regional climatic frameworks. In all, siliceous materials may have been available in this region for the last ten to twenty million years, but the surfaces supporting most past human activity evidence are no older than the late Pleistocene.

A second major feature of this float lithic resource quarry zone (and the Assembly Area as well) is the broad, deep channel known here as Bow Willow Wash. There may be literally thousands of these pluvial features throughout the Mojave Desert, all relicts of much wetter climates and periods of greater pluviality than allowed for under current climatic regimes.

Examination along both sides of Bow Willow Wash revealed the presence of remnant fanglomerate deposits abutting the granitic highlands on the north (see Maps H and I, Appendix A). This suggests that prior to dissection, the Pleistocene fans along the south side of Bow Willow must have graded to the granitic highlands and that development of the pluvial channel probably occurred post-17,000-20,000 years ago (see Photographs 38 and 39). Breached old fanglomerates were also observed at the head of Bow Willow Wash, practically surrounded by grayish, thick deposits of lacustrine beds (Map G, Appendix A). This may have been a zone of considerable moisture, with ponding water and numerous biotic resources for much of the Pleistocene until increasing incision of the channel and changing climatic conditions reduced both lake stands and available moisture, thus leaving the physiographic features found today. This interpretation fits well with that of Abbott (1981), who reported that the southeast shoreline for ancestral No Name Lake once stood in this region until sufficient overflow through the Bow Willow channel downcut deeply enough to drain much of the basin (Abbott 1981:19-20 and Figure 4). Based on regional climatic information and geomorphologic assessments, this probably occurred about 9500 to 10,000 years ago (Shlemon 1981:personal communication; Abbott 1982).

Numerous lineaments and faults course through the Bow Willow region, and displacement of Plio-Pleistocene deposits (and probably the younger fan deposits as well) was noted or observed. Faulting can create permeability situations that control the occurrence of springs in a region, and variations in climatic regime that increase or decrease available moisture in the water table may cause the recurrence or disappearance of springs along these permeable cracks. It is assumed that even when lake stands were low or receding, fresh water and biotic resources may have

been available from springs and seeps along Bow Willow Wash channel.

The pattern suggests that greater diversity and abundance of natural resources other than flake lithic tool material may have been available in this region for much of the late Pleistocene (ca. 10,000-20,000 years ago). Also, changing environmental conditions at the onset of the Holocene may have gradually reduced this abundance, probably very slowly over a long period of time. Because the Bow Willow channel drains isolated, high-elevation basins rather than being a smaller part of larger, low-elevation systems, it is possible that a more moist, locally controlled climatic regime prevailed even into mid-Holocene times (ca. 5000 years ago). The Bow Willow zone could be a remarkable laboratory for the analysis and assessment of changing environments and climatic variation for the late Pleistocene/Holocene transitional periods. If this interpretation of the paleoclimate and paleoenvironment of the Bow Willow Wash region is accepted, several notable questions arise that should be addressed.

Greater abundance and diversity in paleoenvironment vegetation patterns throughout the region would help explain t large number of formal and informal tool types recorded for t cultural sites under discussion. Woodworking tools reported the Silver Lake Road, Assembly, and Bow Willow areas make ser if sufficient stands of mesquite, juniper, or pinon were local available for processing and use. An increase of available food stuffs--roots, seeds, bulbs, blossoms, and small game--may have supported extended family or band-size populations responsible for multiple use sites or complex activity areas reported for locations along the pluvial channel. Robust vegetation at these elevations may have brought grazing and herding animals to the region, further enhancing human use and occupation of this zone.

While the variety and total number of temporally diagnostic artifacts are deficient for so sizable a cultural deposit, the presence of Paleo-Indian forms, Early Prehistoric materials, and Late Prehistoric types provides some lead. There are, no doubt, other materials from each of these three major cultural traditions throughout the float lithic resource areas, and the resource sites identified here may have the potential to add to interpretation of cultural change and development for a very broad span of human prehistory in the northwestern Mojave Desert region.

RESOURCE SIGNIFICANCE ASSESSMENTS

Twenty-five distinct cultural resource sites were identified as a result of this current intensive survey and documentation effort. Material information used to describe and analyze these

resources has been provided in detail above and in preceding sections (III through V).

The nature of this project requires that resources be identified and evaluated by criteria established for nomination for inclusion to the National Register of Historic Places. These criteria state that "The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites . . . and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and . . . that have yielded, or may be likely to yield, information important in prehistory or history" (36 CFR 60.4).

Another approach toward site evaluation criteria which can assist the investigator in determining the "quality of significance" was formulated by a task force in San Diego County which included representatives from the archaeological community (professional, avocational, and academic), construction industry, Native American groups, and administrative or governmental agencies. The basic criteria for evaluation include the cultural site's: 1) integrity (i.e., how intact or disturbed is the site), 2) regional aspect (how the site type is represented on a regional basis), 3) variability of the resource (frequency and density of the material remains), 4) ethnic value (whether the area of the resource holds special meaning for local Native Americans or other associated ethnic populations), 5) site type represented (whether the site contains features of interpretive or educational value), and 6) research potential (whether the site contains information pertinent to the continuing study of cultural processes and behaviors).

To review and assess the resources identified in this study, criteria from both the Federal Regulation and the local government guidelines have been used to complement and refine the resource evaluation process. Site-by-site discussion of resource site assessment is presented below. Recommendations for further research and resource preservation (where warranted) are presented in Section VIII.

<u>4-SBr-4204</u>. This resource appears to be eligible for inclusion to the National Register of Historic Places under criterion (d) of 60.4, 36 CFR 60, for the following reasons:

1. Current investigation of this resource site has resulted in discovery of significant information regarding the prehistory of the northwestern Mojave Desert.

2. Cultural provenience and material context of this resource are in excellent condition owing to its high state of preservation.

3. Relatively extensive cultural deposits were recorded within the boundaries of this resource site, and preliminary analysis suggests the site is likely to yield additional information important to the continuing interpretation of the prehistory of the northwestern Mojave Desert region.

This resource may be significant from a scientific perspective because it has the following characteristics and/or research potential:

1. Apparent variation in the morphology and composition of flaked lithic artifacts that may provide data on site function, special activity areas, problems of temporal placement, selection and use of particular raw materials, and cultural affiliation.

2. Apparent variation in the distribution of artifacts that may provide data on social structure, the division of labor, and/or the organizational structure of the occupation.

3. Potential for relative dating through comparative studies of temporally/culturally diagnostic artifact forms.

4. Potential for obsidian hydration and trace element studies designed to assess relative dates of occupation, length of occupation, degree of site disturbance, and nature of economic exchange systems occupants participated in and to refine the local hydration rate.

5. Potential for comparison with other sites in order to assess variation in land use patterns, settlement patterns, and regional resource exploitation, both in synchronic (contemporary) and diachronic (over time) frameworks.

6. Potential for the occurrence of faunal remains that will provide data on diet, cooking and butchering techniques, seasonality, and paleoenvironmental conditions.

7. Potential for the occurrence of floral remains, such as pollen, that could provide information on diet and paleoenvironmental conditions and change.

8. Variation in stages of reduction of the same general form that could permit further understanding of technological variation in terms of manufacturing steps, application of variable flaking techniques, and, in combination with temporal data, potential assessment of technological change.

9. Variation in the composition of various forms of cryptocrystalline silicates which could be assessed to further define criteria for lithic selection, travel to non-local quarry sources, or possible trade relationships.

10. Spatial association with features and artifacts that could permit refined assessment of similar features elsewhere that are present as isolated occurrences.

11. Possibilities of refined studies of functional attributes in flaked lithic tools designed to permit assessment of variation in exploitation, techniques of use, and possible temporal variation in tool function.

12. Opportunity to assess the problem of superposition (e.g., mixture of assemblages of different temporal periods) and refine techniques for sorting temporally distinct assemblages occurring in the same spatial context.

13. Opportunity to assess the nature of temporary occupation and subsistence-related activities during episodes of quarry exploitation.

4-SBr-4249. This resource appears to be eligible for inclusion to the National Register of Historic Places under criterion (d) of 60.4, 36 CFR 60, for the following reasons:

1. Current investigation of this resource site has resulted in discovery of significant information regarding the prehistory of the northwestern Mojave Desert.

2. Cultural provenience and material context of this resource are in excellent condition owing to its high state of preservation.

3. Relatively extensive cultural deposits were recorded within the boundaries of this resource site, and preliminary analysis suggests the site is likely to yield additional information important to the continuing interpretation of the prehistory of the northwestern Mojave Desert region.

This resource may be significant from a scientific perspective because it has the following characteristics and/or research potential:

1. Apparent variation in the morphology and composition of flaked lithic artifacts that may provide data on site function, special activity areas, problems of temporal

placement, selection and use of particular raw materials, and cultural affiliation.

2. Apparent variation in the distribution of artifacts that may provide data on social structure, the division of labor, and/or the organizational structure of the occupation.

3. Potential for relative dating through comparative studies of temporally/culturally diagnostic artifact forms.

4. Potential for obsidian hydration and trace element studies designed to assess relative dates of occupation, length of occupation, degree of site disturbance, and nature of economic exchange systems occupants participated in and to refine the local hydration rate.

5. Potential for comparison with other sites in order to assess variation in land use patterns, settlement patterns, and regional resource exploitation, both in synchronic (contemporary) and diachronic (over time) frameworks.

6. Variation in stages of reduction of the same general form that could permit further understanding of technological variation in terms of manufacturing steps, application of variable flaking techniques, and, in combination with temporal data, potential assessment of technological change.

7. Variation in the composition of various forms of cryptocrystalline silicates which could be assessed to further define criteria for lithic selection, travel to non-local quarry sources, or possible trade relationships.

8. Spatial association with features and artifacts that could permit refined assessment of similar features elsewhere that are present as isolated occurrences.

9. Possibilities of refined studies of functional attributes in flaked lithic tools designed to permit assessment of variation in exploitation, techniques of use, and possible temporal variation in tool function.

10. Opportunity to assess the problem of superposition (e.g., mixture of assemblages of different temporal periods) and refine techniques for sorting temporally distinct assemblages occurring in the same spatial context.

11. Opportunity to assess the nature of temporary occupation and subsistence-related activities during episodes of quarry exploitation.

4-SBr-4515. This resource appears to be eligible for inclusion to the National Register of Historic Places under criterion (d) of 60.4, 36 CFR 60, for the following reasons:

1. Current investigation of this resource site has resulted in discovery of significant information regarding the prehistory of the northwestern Mojave Desert.

2. Cultural provenience and material context of this resource are in excellent condition owing to its high state of preservation.

3. Relatively extensive cultural deposits were recorded within the boundaries of this resource site, and preliminary analysis suggests the site is likely to yield additional information important to the continuing interpretation of the prehistory of the northwestern Mojave Desert region.

This resource may be significant from a scientific perspective because it has the following characteristics and/or research potential:

1. Apparent variation in the morphology and composition of flaked lithic artifacts that may provide data on site function, special activity areas, problems of temporal placement, selection and use of particular raw materials, and cultural affiliation.

2. Apparent variation in the distribution of artifacts that may provide data on social structure, the division of labor, and/or the organizational structure of the occupation.

3. Potential for relative dating through comparative studies of temporally/culturally diagnostic artifact forms.

4. Variation in stages of reduction of the same general form that could permit further understanding of technological variation in terms of manufacturing steps, application of variable flaking techniques, and, in combination with temporal data, potential assessment of technological change.

5. Variation in the composition of various forms of cryptocrystalline silicates which could be assessed to further define criteria for lithic selection, travel to

non-local quarry sources, or possible trade relationships.

6. Spatial association with features and artifacts that could permit refined assessment of similar features elsewhere that are present as isolated occurrences.

7. Possibilities of refined studies of functional attributes in flaked lithic tools designed to permit assessment of variation in exploitation, techniques of use, and possible temporal variation in tool function.

8. Opportunity to assess the problem of superposition (e.g., mixture of assemblages of different temporal periods) and refine techniques for sorting temporally distinct assemblages occurring in the same spatial context.

9. Opportunity to assess the nature of temporary occupation and subsistence-related activities during episodes of quarry exploitation.

4-SBr-4516. This resource does not appear to be eligible for inclusion to the National Register of Historic Places under criterion (d) of 60.4, 36 CFR 60, for the following reasons:

1. Current investigation of this resource site has resulted in discovery of significant information regarding the prehistory of the northwestern Mojave Desert.

2. Continued military vehicular and pedestrian activity has severely altered the context and integrity of this resource site.

3. Cultural provenience and material context of this resource are in fair condition owing to its reasonable state of preservation.

4. Research potential of this site may have been exhausted by performance of the analysis contained in this present level of investigation.

4-SBr-4727. This resource does not appear to be eligible for inclusion to the National Register of Historic Places under criterion (d) of 60.4, 36 CFR 60, for the following reasons:

1. Current investigation of this resource site has resulted in discovery of significant information regarding the history of the northwestern Mojave Desert.

2. Cultural provenience and material context of this resource are in fair condition owing to its reasonable state of preservation.

3. Research potential of this site may have been exhausted by performance of the analysis contained in this present level of investigation.

4-SBr-4728. This resource does not appear to be eligible for inclusion to the National Register of Historic Places under criterion (d) of 60.4, 36 CFR 60, for the following reasons:

1. Current investigation of this resource site has resulted in discovery of significant information regarding the history of the northwestern Mojave Desert.

2. Cultural provenience and material context of this resource are in good condition owing to its high state of preservation.

3. Research potential of this site may have been exhausted by performance of the analysis contained in this present level of investigation.

4-SBr-4729. This resource appears to be eligible for inclusion to the National Register of Historic Places under criterion (d) of 60.4, 36 CFR 60, for the following reasons:

1. Current investigation of this resource site has resulted in discovery of significant information regarding the prehistory of the northwestern Mojave Desert.

2. Cultural provenience and material context of this resource are in good condition owing to its high state of preservation.

3. Cultural deposits were recorded within the boundaries of this resource site, and preliminary analysis suggests the site is likely to yield additional information important to the continuing interpretation of the prehistory of the northwestern Mojave Desert region.

This resource may be significant from a scientific perspective because it has the following characteristics and/or research potential:

1. Apparent variation in the morphology and composition of flaked lithic artifacts that may provide data on site function, special activity areas, problems of temporal placement, selection and use of particular raw materials, and cultural affiliation.

2. Potential for relative dating through comparative studies of temporally/culturally diagnostic artifact forms.

3. Potential for comparison with other sites in order to assess variation in land use patterns, settlement patterns, and regional resource exploitation, both in synchronic (contemporary) and diachronic (over time) frameworks.

4. Variation in stages of reduction of the same general form that could permit further understanding of technological variation in terms of manufacturing steps, application of variable flaking techniques, and, in combination with temporal data, potential assessment of technological change.

5. Variation in the composition of various forms of cryptocrystalline silicates which could be assessed to further define criteria for lithic selection, travel to non-local quarry sources, or possible trade relationships.

6. Spatial association with features and artifacts that could permit refined assessment of similar features elsewhere that are present as isolated occurrences.

7. Possibilities of refined studies of functional attributes in flaked lithic tools designed to permit assessment of variation in exploitation, techniques of use, and possible temporal variation in tool function.

8. Opportunity to assess the nature of temporary occupation and subsistence-related activities during episodes of quarry exploitation.

4-SBr-4730. This resource appears to be eligible for inclusion to the National Register of Historic Places under criterion (d) of 60.4, 36 CFR 60, for the following reasons:

1. Current investigation of this resource site has resulted in discovery of significant information regarding the prehistory of the northwestern Mojave Desert.

2. Cultural provenience and material context of this resource are in good condition owing to its high state of preservation.

3. Cultural deposits were recorded within the boundaries of this resource site, and preliminary analysis suggests the site is likely to yield additional information

important to the continuing interpretation of the prehistory of the northwestern Mojave Desert region.

This resource may be significant from a scientific perspective because it has the following characteristics and/or research potential:

1. Potential for relative dating through comparative studies of temporally/culturally diagnostic artifact forms.

2. Potential for comparison with other sites in order to assess variation in land use patterns, settlement patterns, and regional resource exploitation, both in synchronic (contemporary) and diachronic (over time) frameworks.

3. Variation in stages of reduction of the same general form that could permit further understanding of technological variation in terms of manufacturing steps, application of variable flaking techniques, and, in combination with temporal data, potential assessment of technological change.

4. Variation in the composition of various forms of cryptocrystalline silicates which could be assessed to further define criteria for lithic selection, travel to non-local quarry sources, or possible trade relationships.

5. Spatial association with features and artifacts that could permit refined assessment of similar features elsewhere that are present as isolated occurrences.

6. Opportunity to assess the nature of temporary occupation and subsistence-related activities during episodes of quarry exploitation.

4-SBr-4732. This resource appears to be eligible for inclusion to the National Register of Historic Places under criterion (d) of 60.4, 36 CFR 60, for the following reasons:

1. Current investigation of this resource site has resulted in discovery of significant information regarding the prehistory of the northwestern Mojave Desert.

2. Cultural provenience and material context of this resource are in good condition owing to its high state of preservation.

3. Cultural deposits were recorded within the boundaries of this resource site, and preliminary analysis suggests

the site is likely to yield additional information important to the continuing interpretation of the prehistory of the northwestern Mojave Desert region.

This resource may be significant from a scientific perspective because it has the following characteristics and/or research potential:

1. Apparent variation in the morphology and composition of flaked lithic artifacts that may provide data on site function, special activity areas, problems of temporal placement, selection and use of particular raw materials, and cultural affiliation.

2. Potential for relative dating through comparative studies of temporally/culturally diagnostic artifact forms.

3. Potential for comparison with other sites in order to assess variation in land use patterns, settlement patterns, and regional resource exploitation, both in synchronic (contemporary) and diachronic (over time) frameworks.

4. Variation in stages of reduction of the same general form that could permit further understanding of technological variation in terms of manufacturing steps, application of variable flaking techniques, and, in combination with temporal data, potential assessment of technological change.

5. Variation in the composition of various forms of cryptocrystalline silicates which could be assessed to further define criteria for lithic selection, travel to non-local quarry sources, or possible trade relationships.

6. Spatial association with features and artifacts that could permit refined assessment of similar features elsewhere that are present as isolated occurrences.

4-SBr-4733. This resource appears to be eligible for inclusion to the National Register of Historic Places under criterion (d) of 60.4, 36 CFR 60, for the following reasons:

1. Current investigation of this resource site has resulted in discovery of significant information regarding the prehistory of the northwestern Mojave Desert.

2. Cultural provenience and material context of this resource are in good condition owing to its high state of preservation.

3. Cultural deposits were recorded within the boundaries of this resource site, and preliminary analysis suggests the site is likely to yield additional information important to the continuing interpretation of the prehistory of the northwestern Mojave Desert region.

This resource may be significant from a scientific perspective because it has the following characteristics and/or research potential:

1. Potential for relative dating through comparative studies of temporally/culturally diagnostic artifact forms.

2. Potential for comparison with other sites in order to assess variation in land use patterns, settlement patterns, and regional resource exploitation, both in synchronic (contemporary) and diachronic (over time) frameworks.

3. Variation in stages of reduction of the same general form that could permit further understanding of technological variation in terms of manufacturing steps, application of variable flaking techniques, and, in combination with temporal data, potential assessment of technological change.

4. Variation in the composition of various forms of cryptocrystalline silicates which could be assessed to further define criteria for lithic selection, travel to non-local quarry sources, or possible trade relationships.

5. Spatial association with features and artifacts that could permit refined assessment of similar features elsewhere that are present as isolated occurrences.

6. Possibilities of refined studies of functional attributes in flaked lithic tools designed to permit assessment of variation in exploitation, techniques of use, and possible temporal variation in tool function.

7. Opportunity to assess the nature of temporary occupation and subsistence-related activities during episodes of quarry exploitation.

4-SBr-4734. This resource appears to be eligible for inclusion to the National Register of Historic Places under criterion (d) of 60.4, 36 CFR 60, for the following reasons:

1. Current investigation of this resource site has resulted in discovery of significant information regarding the prehistory of the northwestern Mojave Desert.

2. Cultural provenience and material context of this resource are in good condition owing to its high state of preservation.

3. Cultural deposits were recorded within the boundaries of this resource site, and preliminary analysis suggests the site is likely to yield additional information important to the continuing interpretation of the prehistory of the northwestern Mojave Desert region.

This resource may be significant from a scientific perspective because it has the following characteristics and/or research potential:

1. Apparent variation in the morphology and composition of flaked lithic artifacts that may provide data on site function, special activity areas, problems of temporal placement, selection and use of particular raw materials, and cultural affiliation.

2. Apparent variation in the distribution of artifacts that may provide data on social structure, the division of labor, and/or the organizational structure of the occupation.

3. Potential for relative dating through comparative studies of temporally/culturally diagnostic artifact forms.

4. Potential for comparison with other sites in order to assess variation in land use patterns, settlement patterns, and regional resource exploitation, both in synchronic (contemporary) and diachronic (over time) frameworks.

5. Variation in stages of reduction of the same general form that could permit further understanding of technological variation in terms of manufacturing steps, application of variable flaking techniques, and, in combination with temporal data, potential assessment of technological change.

6. Variation in the composition of various forms of cryptocrystalline silicates which could be assessed to further define criteria for lithic selection, travel to non-local quarry sources, or possible trade relationships.

7. Spatial association with features and artifacts that could permit refined assessment of similar features elsewhere that are present as isolated occurrences.

8. Possibilities of refined studies of functional attributes in flaked lithic tools designed to permit assessment of variation in exploitation, techniques of use, and possible temporal variation in tool function.

9. Opportunity to assess the problem of superposition (e.g., mixture of assemblages of different temporal periods) and refine techniques for sorting temporally distinct assemblages occurring in the same spatial context.

10. Opportunity to assess the nature of temporary occupation and subsistence-related activities during episodes of quarry exploitation.

4-SBr-4735. This resource appears to be eligible for inclusion to the National Register of Historic Places under criterion (d) of 60.4, 36 CFR 60, for the following reasons:

1. Current investigation of this resource site has resulted in discovery of significant information regarding the prehistory of the northwestern Mojave Desert.

2. Cultural provenience and material context of this resource are in good condition owing to its high state of preservation.

3. Cultural deposits were recorded within the boundaries of this resource site, and preliminary analysis suggests the site is likely to yield additional information important to the continuing interpretation of the prehistory of the northwestern Mojave Desert region.

This resource may be significant from a scientific perspective because it has the following characteristics and/or research potential:

1. Potential for relative dating through comparative studies of temporally/culturally diagnostic artifact forms.

2. Potential for comparison with other sites in order to assess variation in land use patterns, settlement patterns, and regional resource exploitation, both in synchronic (contemporary) and diachronic (over time) frameworks.

3. Variation in stages of reduction of the same general form that could permit further understanding of technological variation in terms of manufacturing steps, application of variable flaking techniques, and, in combination with temporal data, potential assessment of technological change.

4. Spatial association with features and artifacts that could permit refined assessment of similar features elsewhere that are present as isolated occurrences.

5. Opportunity to assess the problem of superposition (e.g., mixture of assemblages of different temporal periods) and refine techniques for sorting temporally distinct assemblages occurring in the same spatial context.

6. Opportunity to assess the nature of temporary occupation and subsistence-related activities during episodes of quarry exploitation.

4-SBr-4736. This resource appears to be eligible for inclusion to the National Register of Historic Places under criterion (d) of 60.4, 36 CFR 60, for the following reasons:

1. Current investigation of this resource site has resulted in discovery of significant information regarding the prehistory of the northwestern Mojave Desert.

2. Cultural provenience and material context of this resource are in good condition owing to its high state of preservation.

3. Cultural deposits were recorded within the boundaries of this resource site, and preliminary analysis suggests the site is likely to yield additional information important to the continuing interpretation of the prehistory of the northwestern Mojave Desert region.

This resource may be significant from a scientific perspective because it has the following characteristics and/or research potential:

1. Apparent variation in the morphology and composition of flaked lithic artifacts that may provide data on site function, special activity areas, problems of temporal placement, selection and use of particular raw materials, and cultural affiliation.

2. Apparent variation in the distribution of artifacts that may provide data on social structure, the division

of labor, and/or the organizational structure of the occupation.

3. Potential for relative dating through comparative studies of temporally/culturally diagnostic artifact forms.

4. Potential for obsidian hydration and trace element studies designed to assess relative dates of occupation, length of occupation, degree of site disturbance, and nature of economic exchange systems occupants participated in and to refine the local hydration rate.

5. Variation in stages of reduction of the same general form that could permit further understanding of technological variation in terms of manufacturing steps, application of variable flaking techniques, and, in combination with temporal data, potential assessment of technological change.

6. Variation in the composition of various forms of cryptocrystalline silicates which could be assessed to further define criteria for lithic selection, travel to non-local quarry sources, or possible trade relationships.

7. Spatial association with features and artifacts that could permit refined assessment of similar features elsewhere that are present as isolated occurrences.

8. Possibilities of refined studies of functional attributes in flaked lithic tools designed to permit assessment of variation in exploitation, techniques of use, and possible temporal variation in tool function.

9. Opportunity to assess the problem of superposition (e.g., mixture of assemblages of different temporal periods) and refine techniques for sorting temporally distinct assemblages occurring in the same spatial context.

10. Opportunity to assess the nature of temporary occupation and subsistence-related activities during episodes of quarry exploitation.

4-SBr-4741. This resource does not appear to be eligible for inclusion to the National Register of Historic Places under criterion (d) of 60.4, 36 CFR 60, for the following reasons:

1. Current investigation of this resource site has resulted in discovery of significant information regarding the history of the northwestern Mojave Desert.

2. Cultural provenience and material context of this resource are in excellent condition owing to its high state of preservation.

3. Research potential of this site may have been exhausted by performance of the analysis contained in this present level of investigation.

4-SBr-4742. This resource does not appear to be eligible for inclusion to the National Register of Historic Places under criterion (d) of 60.4, 36 CFR 60, for the following reasons:

1. Ongoing natural erosion has severely disturbed the integrity of this resource site.

2. Continued military vehicular and pedestrian activity has severely altered the context and integrity of this resource site.

3. Research potential of this site may have been exhausted by performance of the analysis contained in this present level of investigation.

4-SBr-4743. This resource does not appear to be eligible for inclusion to the National Register of Historic Places under criterion (d) of 60.4, 36 CFR 60, for the following reasons:

1. Ongoing natural erosion has severely disturbed the integrity of this resource site.

2. Continued military vehicular and pedestrian activity has severely altered the context and integrity of this resource site.

3. Research potential of this site may have been exhausted by performance of the analysis contained in this present level of investigation.

4-SBr-4744. This resource appears to be eligible for inclusion to the National Register of Historic Places under criterion (d) of 60.4, 36 CFR 60, for the following reasons:

1. Current investigation of this resource site has resulted in discovery of significant information regarding the prehistory of the northwestern Mojave Desert.

2. Cultural provenience and material context of this resource are in excellent condition owing to its high state of preservation.

3. Cultural deposits were recorded within the boundaries of this resource site, and preliminary analysis suggests

the site is likely to yield additional information important to the continuing interpretation of the prehistory of the northwestern Mojave Desert region.

This resource may be significant from a scientific perspective because it has the following characteristics and/or research potential:

1. Potential for relative dating through comparative studies of temporally/culturally diagnostic artifact forms.

2. Potential for comparison with other sites in order to assess variation in land use patterns, settlement patterns, and regional resource exploitation, both in synchronic (contemporary) and diachronic (over time) frameworks.

3. Variation in stages of reduction of the same general form that could permit further understanding of technological variation in terms of manufacturing steps, application of variable flaking techniques, and, in combination with temporal data, potential assessment of technological change.

4. Opportunity to assess the nature of temporary occupation and subsistence-related activities during episodes of quarry exploitation.

4-SBr-4745. This resource appears to be eligible for inclusion to the National Register of Historic Places under criterion (d) of 60.4, 36 CFR 60, for the following reasons:

1. Current investigation of this resource site has resulted in discovery of significant information regarding the prehistory of the northwestern Mojave Desert.

2. Cultural provenience and material context of this resource are in good condition owing to its high state of preservation.

3. Cultural deposits were recorded within the boundaries of this resource site, and preliminary analysis suggests the site is likely to yield additional information important to the continuing interpretation of the prehistory of the northwestern Mojave Desert region.

This resource may be significant from a scientific perspective because it has the following characteristics and/or research potential:

1. Potential for comparison with other sites in order to assess variation in land use patterns, settlement patterns, and regional resource exploitation, both in synchronic (contemporary) and diachronic (over time) frameworks.

2. Variation in stages of reduction of the same general form that could permit further understanding of technological variation in terms of manufacturing steps, application of variable flaking techniques, and, in combination with temporal data, potential assessment of technological change.

3. Opportunity to assess the nature of temporary occupation and subsistence-related activities during episodes of quarry exploitation.

<u>4-SBr-4746</u>. This resource appears to be eligible for inclusion to the National Register of Historic Places under criterion (d) of 60.4, 36 CFR 60, for the following reasons:

1. Current investigation of this resource site has resulted in discovery of significant information regarding the prehistory of the northwestern Mojave Desert.

2. Cultural provenience and material context of this resource are in good condition owing to its high state of preservation.

3. Relatively extensive cultural deposits were recorded within the boundaries of this resource site, and preliminary analysis suggests the site is likely to yield additional information important to the continuing interpretation of the prehistory of the northwestern Mojave Desert region.

This resource may be significant from a scientific perspective because it has the following characteristics and/or research potential:

1. Apparent variation in the morphology and composition of flaked lithic artifacts that may provide data on site function, special activity areas, problems of temporal placement, selection and use of particular raw materials, and cultural affiliation.

2. Apparent variation in the distribution of artifacts that may provide data on social structure, the division of labor, and/or the organizational structure of the occupation.

3. Potential for relative dating through comparative studies of temporally/culturally diagnostic artifact forms.

4. Potential for comparison with other sites in order to assess variation in land use patterns, settlement patterns, and regional resource exploitation, both in synchronic (contemporary) and diachronic (over time) frameworks.

5. Variation in stages of reduction of the same general form that could permit further understanding of technological variation in terms of manufacturing steps, application of variable flaking techniques, and, in combination with temporal data, potential assessment of technological change.

6. Variation in the composition of various forms of cryptocrystalline silicates which could be assessed to further define criteria for lithic selection, travel to non-local quarry sources, or possible trade relationships.

7. Spatial association with features and artifacts that could permit refined assessment of similar features elsewhere that are present as isolated occurrences.

8. Possibilities of refined studies of functional attributes in flaked lithic tools designed to permit assessment of variation in exploitation, techniques of use, and possible temporal variation in tool function.

9. Opportunity to assess the problem of superposition (e.g., mixture of assemblages of different temporal periods) and refine techniques for sorting temporally distinct assemblages occurring in the same spatial context.

10. Opportunity to assess the nature of temporary occupation and subsistence-related activities during episodes of quarry exploitation.

4-SBr-4747. This resource does not appear to be eligible for inclusion to the National Register of Historic Places under criterion (d) of 60.4, 36 CFR 60, for the following reasons:

1. Current investigation of this resource site has resulted in discovery of significant information regarding the history of the northwestern Mojave Desert.

2. Cultural provenience and material context of this resource are in fair condition owing to its reasonable state of preservation.

3. Research potential of this site may have been exhausted by performance of the analysis contained in this present level of investigation.

4-SBr-4748. This resource does not appear to be eligible for inclusion to the National Register of Historic Places under criterion (d) of 60.4, 36 CFR 60, for the following reasons:

1. Current investigation of this resource site has resulted in discovery of significant information regarding the history of the northwestern Mojave Desert.

2. Cultural provenience and material context of this resource are in fair condition owing to its reasonable state of preservation.

3. Research potential of this site may have been exhausted by performance of the analysis contained in this present level of investigation.

4-SBr-4749. This resource appears to be eligible for inclusion to the National Register of Historic Places under criterion (d) of 60.4, 36 CFR 60, for the following reasons:

1. Current investigation of this resource site has resulted in discovery of significant information regarding the prehistory of the northwestern Mojave Desert.

2. Cultural provenience and material context of this resource are in excellent condition owing to its high state of preservation.

3. Cultural deposits were recorded within the boundaries of this resource site, and preliminary analysis suggests the site is likely to yield additional information important to the continuing interpretation of the prehistory of the northwestern Mojave Desert region.

This resource may be significant from a scientific perspective because it has the following characteristics and/or research potential:

1. Potential for relative dating through comparative studies of temporally/culturally diagnostic artifact forms.

2. Potential for comparison with other sites in order to assess variation in land use patterns, settlement

patterns, and regional resource exploitation, both in synchronic (contemporary) and diachronic (over time) frameworks.

3. Variation in the composition of various forms of cryptocrystalline silicates which could be assessed to further define criteria for lithic selection, travel to non-local quarry sources, or possible trade relationships.

4. Spatial association with features and artifacts that could permit refined assessment of similar features elsewhere that are present as isolated occurrences.

5. Opportunity to assess the nature of temporary occupation and subsistence-related activities during episodes of quarry exploitation.

4-SBr-4750. This resource appears to be eligible for inclusion to the National Register of Historic Places under criterion (d) of 60.4, 36 CFR 60, for the following reasons:

1. Current investigation of this resource site has resulted in discovery of significant information regarding the prehistory of the northwestern Mojave Desert.

2. Cultural provenience and material context of this resource are in good condition owing to its high state of preservation.

3. Cultural deposits were recorded within the boundaries of this resource site, and preliminary analysis suggests the site is likely to yield additional information important to the continuing interpretation of the prehistory of the northwestern Mojave Desert region.

This resource may be significant from a scientific perspective because it has the following characteristics and/or research potential:

1. Apparent variation in the morphology and composition of flaked lithic artifacts that may provide data on site function, special activity areas, problems of temporal placement, selection and use of particular raw materials, and cultural affiliation.

2. Potential for relative dating through comparative studies of temporally/culturally diagnostic artifact forms.

3. Potential for comparison with other sites in order to assess variation in land use patterns, settlement

patterns, and regional resource exploitation, both in synchronic (contemporary) and diachronic (over time) frameworks.

4. Variation in the composition of various forms of cryptocrystalline silicates which could be assessed to further define criteria for lithic selection, travel to non-local quarry sources, or possible trade relationships.

5. Spatial association with features and artifacts that could permit refined assessment of similar features elsewhere that are present as isolated occurrences.

6. Possibilities of refined studies of functional attributes in flaked lithic tools designed to permit assessment of variation in exploitation, techniques of use, and possible temporal variation in tool function.

7. Opportunity to assess the nature of temporary occupation and subsistence-related activities during episodes of quarry exploitation.

4-SBr-4751. This resource appears to be eligible for inclusion to the National Register of Historic Places under criterion (d) of 60.4, 36 CFR 60, for the following reasons:

1. Current investigation of this resource site has resulted in discovery of significant information regarding the prehistory of the northwestern Mojave Desert.

2. Cultural provenience and material context of this resource are in excellent condition owing to its high state of preservation.

3. Cultural deposits were recorded within the boundaries of this resource site, and preliminary analysis suggests the site is likely to yield additional information important to the continuing interpretation of the prehistory of the northwestern Mojave Desert region.

This resource may be significant from a scientific perspective because it has the following characteristics and/or research potential:

1. Potential for relative dating through comparative studies of temporally/culturally diagnostic artifact forms.

2. Potential for comparison with other sites in order to assess variation in land use patterns, settlement patterns, and regional resource exploitation, both in

synchronic (contemporary) and diachronic (over time) frameworks.

3. Spatial association with features and artifacts that could permit refined assessment of similar features elsewhere that are present as isolated occurrences.

4. Possibilities of refined studies of functional attributes in flaked lithic tools designed to permit assessment of variation in exploitation, techniques of use, and possible temporal variation in tool function.

5. Opportunity to assess the problem of superposition (e.g., mixture of assemblages of different temporal periods) and refine techniques for sorting temporally distinct assemblages occurring in the same spatial context.

6. Opportunity to assess the nature of temporary occupation and subsistence-related activities during episodes of quarry exploitation.

4-SBr-4752. This resource appears to be eligible for inclusion to the National Register of Historic Places under criterion (d) of 60.4, 36 CFR 60, for the following reasons:

1. Current investigation of this resource site has resulted in discovery of significant information regarding the prehistory of the northwestern Mojave Desert.

2. Cultural provenience and material context of this resource are in fair condition owing to its reasonable state of preservation.

3. Cultural deposits were recorded within the boundaries of this resource site, and preliminary analysis suggests the site is likely to yield additional information important to the continuing interpretation of the prehistory of the northwestern Mojave Desert region.

This resource may be significant from a scientific perspective because it has the following characteristics and/or research potential:

1. Potential for relative dating through comparative studies of temporally/culturally diagnostic artifact forms.

2. Potential for comparison with other sites in order to assess variation in land use patterns, settlement patterns, and regional resource exploitation, both in

synchronic (contemporary) and diachronic (over time) frameworks.

3. Variation in the composition of various forms of cryptocrystalline silicates which could be assessed to further define criteria for lithic selection, travel to non-local quarry sources, or possible trade relationships.

4. Spatial association with features and artifacts that could permit refined assessment of similar features elsewhere that are present as isolated occurrences.

5. Opportunity to assess the nature of temporary occupation and subsistence-related activities during episodes of quarry exploitation.

Aside from the scientific potential of these cultural resources, the remnant deposits have great potential for interpretive and educational value to the general public, although the practicalities of this significance aspect are remote (due to current and future military land use). The inherent value is present in the form of high concentrations of exhibit-quality artifacts and the variety and form of other intersite variations.

Yet another significance category of importance is ethnic value. Evaluation of ethnic considerations is best provided by representatives of the associated local ethnic populations. In the case of these resources, Native American consultation could provide interpretive information and a better-founded statement regarding ethnic value. Advice on this consideration is currently being sought by representatives from the National Park Service, Western Regional Office.

Concerning the criteria established by the Secretary of the Interior for use in evaluating and determining the eligibility of properties for listing in the National Register (36 CFR 60.6), these sites stand out as resources possessing unquestionable integrity and measurable importance to both local and regional prehistories. The sites are distinctive. Their value as research tools and interpretable resources is most significant, and more complete examination of these resources is likely to prove seminal to refinement of the chronological order and temporal identity of cultural patterns and land use practices in the northwestern Mojave Desert region.

SECTION VII

REVIEW OF POTENTIAL FOR ADVERSE EFFECTS

Fort Irwin's role in training and indoctrination programs for U.S. Army, Forces Command (FORSCOM) requires that the Live Fire Maneuver Range be available for intensive training and warfare exercises beginning in the fall of 1981 (U.S. Army 1980a:16). Operations in the several study zones discussed in this report will place tank targets, maneuver zones, support facilities, and assembly areas for live fire training tactics throughout the area before the end of fiscal year 1982. Land use and training maneuvers will increase gradually over time to allow the training mission's purpose, plan, and effectiveness to develop efficiently. In an article published by the official U.S. Army journal, it was reported that:

> Once Fort Irwin becomes the National Training Center, it will be phased into full operation. From now through Fiscal Year (FY) 81, the concept and the training methods to be used will be tested and refined. About eight to 10 battalions will go through the center during this phase. The second phase begins in FY 82 when it's expected that the total training system . . . will be in place. By FY 84, some 42 armor and mechanized infantry battalions will be training at the center each year. This means each of these type battalions in Forces Command will rotate through the NTC program every 18 months. They'll spend two weeks at the center (U.S. Army 1980b:20).

In preparation for the opening of the National Training Center, the U.S. Army has conducted a series of training exercises at Fort Irwin, the largest being the 1980 Gallant Eagle maneuvers. This exercise involved 15,000 soldiers, 7,000 marines, and 3,000 airmen in a full combined arms operation supported by 140 tactical aircraft, some 600 tanks and armored personnel carriers, and more than 100 helicopters (U.S. Army 1980b:21). Although the Gallant Eagle maneuver was well planned and executed, it was conducted in less than full compliance with Federal law (National Historic Preservation Act (Public Law 89-665), Executive Order 11593, 36 CFR 800) and Army Regulation 200-1, Chapter 8.

It is useful here to briefly summarize--in capsule form--existing conditions of the resources under discussion at the time of their most recent investigation. With this information, it is possible to summarize potential adverse effects to the resources currently under examination.

Twenty-five cultural resource sites have been identified and addressed in the current study, which focused on three zones of

the proposed Live Fire Maneuver Range, as presented in the introduction to this report (see Table 13 and Figure 2). The zones, as a part of the greater Fort Irwin training range, have been subjected to some impacts throughout this region's military history. As these earlier impacts form a portion of the data analyzed in assessing a resource site's condition, they have been documented and considered in analysis of each resource's significance assessment. In only a few cases have military impacts combined with natural erosional factors to reduce a site's potential eligibility for National Register nomination, while the remainder owe their preservation to a combination of factors, all related to the reservation's recent military history as outlined below:

1) The reserve is of tremendous size (643,000 acres) and presents a real challenge to large-scale bivouac of numerous troops with their requisite equipment, supplies, and front-line supports.

2) As a consequence, training range land use programs have been outlined with efficiency of supply and service in mind; formal gunnery ranges with target sheds and bunkhouses are patterned to service roads and arterial transportation routes.

3) While a large military population of permanently stationed and transient personnel is not uncommon to the Fort Irwin Military Reservation, much of its history records a small population of support personnel with seasonal increases for scheduled training periods.

Current land use in this zone is multiple. The broadest use to date is as range fans for several frequently used gunnery ranges of varying weapon calibers and tactical training design (Davis, Eckhardt and Hatley 1981:Figure 34). Nonetheless, the majority of the resources remain in excellent condition, owing to the formal nature of gunnery range use and regulations (Post Regulation 350-3), the maintenance and use of established roads and tank trails, and restrictions against extracurricular vehicle activity. A second use portends the development of the National Training Center's Live Fire Maneuver Range (LFMR). This includes numerous small-scale training exercises using the area and perimeter of the proposed LFMR, as well as larger, full-scale exercises, all of which tested the proposed range for its military training potential. The 1980 Gallant Eagle exercise is a fair example of the effects these training procedures can have on the cultural resources of a given zone (Kaldenberg 1980a, 1980b; cf. U.S. Army 1980b:18-22).

Given implementation of the proposed Live Fire Maneuver Range, land use of the Fort Irwin Military Reservation will increase tremendously. Considering environmental impacts from

Table 13

SYNOPSIS OF RESOURCE SITES AND THEIR CONDITIONS

Site Number	Portion of Proposed LFMR	Brief Description	Condition	Potential Eligibility for NRHP	Material Sample Collected
4-SBr-4204	Offense	Stream channel terrace workshop/encampment, 4800x700 meters, numerous activity zones and loci exhibiting wide spectrum of artifacts	Excellent	Yes	Yes
4-SBr-4249	Assembly	Stream channel terrace workshop/encampment, 4100x440 meters, numerous activity zones and loci exhibiting wide spectrum of artifacts	Excellent	Yes	Yes
4-SBr-4515	Offense	Complex workshop/encampment, 2300x550 meters, numerous activity zones and loci exhibiting wide spectrum of artifacts	Excellent	Yes	No
4-SBr-4516	Offense	Core reduction center divided into two loci totaling 650x200 meters, numerous flake scatters, cores, biface forms	Good	Doubtful	No
4-SBr-4727	Offense	1 rock cairn, 1x0.8 meter, 15 granodiorite rocks, 1 course high	Fair	Doubtful	No
4-SBr-4728	Offense	1 rock cairn, 1x0.75 meter, primarily granitic, 2 courses	Good	Doubtful	No
4-SBr-4729	Assembly	Complex containing flake scatters and core reduction stations, 34x15 meters, 120+ flakes/debitage, 2 cobble-based tools, 6+ cores, all chalcedony	Good	Yes	No
4-SBr-4730	Assembly	Lithic scatter, 20x15 meters, 1 tool, 8 cores, 66+ flakes, all chalcedony	Good	Yes	No

Table 13
SYNOPSIS OF RESOURCE SITES AND THEIR CONDITIONS
(continued)

Site Number	Portion of Proposed LFMR	Brief Description	Condition	Potential Eligibility for NRHP	Material Sample Collected
4-SBr-4732	Offense	Lithic scatter, 115x40 meters, 300+ chalcedony flakes/debitage, 20 bifacially worked flakes, 1 basalt core, 1 chalcedony core	Good	Yes	No
4-SBr-4733	Assembly	Lithic scatter, 4.5x4.25 meters, 60+ flakes, 2 cores, 1 truncated biface fragment, all chalcedony	Good	Yes	No
4-SBr-4734	Assembly	Lithic scatter, flake scatters, reduction areas, isolated artifacts, 100+ flakes, 2 cores, 3 bifaces, 1 scraper-like tool, chalcedony	Good	Yes	No
4-SBr-4735	Offense	Lithic scatter, 12x35 meters, 13+ flakes, 2 cores, all chalcedony, 1 recent rock ring	Good	Yes	No
4-SBr-4736	Offense	Lithic scatter, 25x65 meters, 100+ flakes, 2 cores, chalcedony, chert, obsidian, 1 chalcedony projectile point tip	Good	Yes	No
4-SBr-4741	Offense	1 rock cairn, 1 meter diameter, 83 centimeters high	Excellent	Doubtful	No
4-SBr-4742	Offense	1 flake scatter, 36x12 meters, 14 flakes, 1 unifacially flaked tool, 1 core, all chalcedony	Poor	Doubtful	Yes
4-SBr-4743	Assembly	Lithic scatter, 50x35 meters, 1 core, 48 flakes, all chalcedony	Poor	Doubtful	Yes

Table 13
SYNOPSIS OF RESOURCE SITES AND THEIR CONDITIONS
(continued)

Site Number	Portion of Proposed LFMR	Brief Description	Condition	Potential Eligibility for NRHP	Material Sample Collected
4-SBr-4744	Offense	Flake scatter, 36x36 meters, 30 chalcedony flakes	Excellent	Yes	No
4-SBr-4745	Assembly	Core reduction station, 31x10 meters, 4 cores, 54+ flakes, 1 tool (possible burin), all jasper	Good	Possible	Yes
4-SBr-4746	Assembly	Large site complex, 12 loci of core reduction centers, lithic scatters, grinding implements, 212.5x75 meters, numerous activity zones and loci exhibiting wide spectrum of artifacts	Good	Yes	No
4-SBr-4747	Offense	1 rock cairn, 1.1 meters diameter, deflated, 30 granodiorite stones	Fair	Doubtful	No
4-SBr-4748	Offense	1 rock cairn, 6 stacked rocks, 59x52 centimeters, 60 centimeters high, additional 12 rocks once aspect of cairn, overall area 1.8x1.6 meters	Fair	Doubtful	No
4-SBr-4749	Offense	Lithic reduction station, 3x1.5 meters, 30-40 primary chalcedony flakes	Excellent	Yes	No
4-SBr-4750	Offense	Core reduction station, 3x5 meters, 9 flakes, 5 cores, 1 biface fragment, 1 bifacially flaked tool fragment, all chalcedony	Good	Possible	Yes
4-SBr-4751	Offense	Rock ring, 3 meters diameter, basalt stones, other possible rock features in vicinity, 1 utilized chalcedony flake 26 meters north	Excellent	Yes	No

Table 13
SYNOPSIS OF RESOURCE SITES AND THEIR CONDITIONS
(continued)

Site Number	Portion of Proposed LFMR	Brief Description	Condition	Potential Eligibility for NRHP	Material Sample Collected
4-SBr-4752	Assembly	Complex of 3 loci and 1 associated isolate, 53x7 meters, 100+ chalcedony flakes/debitage, 1 basalt flake, 1 chalcedony ovate biface, 1 unifacial felsite scraper, 1 chalcedony tool	Fair	Possible	No

the entire National Training Center development, it has been reported that field training exercises will increase by roughly 75 percent over fiscal year 1978 use levels (U.S. Army 1979:44):

> Expanded military use of the Fort Irwin Reservation by 75 percent will increase the intensity of activities causing physical change and most likely will speed up the rate of such change.

The effect of concentrating use by tank battalion rotations in the Live Fire Maneuver Range is an expected increase in soil disturbance and erosion. Use of wheeled and tracked vehicles on the LFMR will have several direct impacts if allowed to encroach on cultural resources. Direct mechanical action will exert compaction and shear forces on the soil, desert pavement surface, and surface artifacts. In general, the degree of damage is proportional to the energy applied. Therefore, the greater number of passes of vehicles over a given area, the greater the overall damage. Both compaction and shear stress disturb soil structure and result in physical changes which can alter local water regimes and disturb variability of soil temperatures, which in turn affect the total ecology. The effects of compaction and shear stress to surface artifacts have not yet been quantified, although their forces are frequently listed as disturbances (Alsoszatei-Petheo 1978; Kaldenberg 1978, 1980a, 1980b; Davis, Eckhardt and Hatley 1980; Bull 1980).

Clasts and gravels that make up desert pavements will also be disturbed by increased vehicular and tactical training activities. Disturbance of the pavement surface or vitreous A horizon will expose a mixture of cobbles, pebbles, sands, and silts, promoting accelerated erosion. Disturbed surfaces will become more susceptible to erosion from water and wind. Artifacts may be carried downslope with the loosened soils and redeposited in washes and flats.

Other foreseeable training activities with potential to result in direct impacts to cultural resources include bivouac sites, assembly areas, and the impact of live fire ordnance from both aircraft and ground sources. Battalions using the range will be supported by artillery, engineer, air defense, signal, logistics, intelligence, and electronic warfare units normally supporting such battalions in warfare (U.S. Army 1980b:20). An armored or mechanized infantry battalion will be cross-reinforced so that armored units will have at least one mechanized infantry company attached, and vice versa (U.S. Army 1980a:5). Activities associated with both bivouacs and assemblies have not been outlined in detail, but are sure to include camp maintenance, mess operations, and free-time activities. Both surface and subsurface disturbances are foreseen in terms of vehicle staging areas, buried communication lines, disposal of refuse, and

physical training activities. All will lead to accelerated erosion and a gradual reduction in the quality of the environment.

The use of live ordnance for select target areas will immediately disturb a number of environmental resources and has potential to disturb cultural resources as well. Larger calibers will, of course, have greater impact than small arms fire. It is expected that continual degradation of target sites (over time) will require their relocation at subsequent periods in the future (Fitter 1980:personal communication). General review of present target areas shows very large impact zones. Impacts to planned target locations are anticipated to be greater than previously believed and may impact cultural resources beyond the thirty-meter-radius survey zones reviewed during past investigation efforts.

The combined arms training program, when fully operational, will support brigade-size military units consisting of 154 tracked vehicles and their logistic support complements, with forty-two rotations scheduled each year (Dean 1980:personal communication). This proposal has great potential to disrupt or destroy cultural resources which appear eligible for the National Register, and recommendations to mitigate those impacts are warranted.

SECTION VIII

CONCLUSIONS AND RECOMMENDATIONS

As a result of this study, considerable new information has been developed relating to the pattern and practice of indigenous land use activities in the northwestern Mojave Desert. For the most part, the record subjected to examination reflects both extractive and maintenance strategies employed by numerous individuals and groups of unknown populations over long periods of time. Set in an environment markedly different from today's arid climate, the resources exhibit refuse associated with more moist and cool conditions when lush vegetation, standing lakes, and increased populations of large game are known to have been abundant. Broad expanses of alluvial plain have been inspected and identified as major quarry resource zones where suitably high-grade siliceous rock was worked into core, biface, and tool forms. Encampments were also observed in these regions, signifying an interrelationship between maintenance of social order on small band or extended family levels and procurement of extraordinarily important material resources. The findings suggest very complex interactions between these human populations and the variable environments from which natural resources were exploited.

The cultural deposits have been subjected to various levels of impact by previous military activities; however, present site conditions retain a relatively high level of integrity as compared to other locations within the Fort Irwin Military Reservation and other portions of the Mojave Desert. Based on the current assessment, numerous research questions have been identified but remain unanswered. High potential exists for these resources to address problems of human behavior and adaptive strategies, key areas of contemporary research orientation which will clarify understanding of prehistoric lifeways.

It is anticipated that planned future land use within the Live Fire Maneuver Range (LFMR) will have severe negative impact to resources within the regions subjected to inspection (see Section VII). Figure 29 further illustrates the extensive nature of planned military training maneuvers in this area. Significant and important cultural resources have been identified in all four land use priority zones, and their variability and content have not been scrutinized closely enough to warrant loss of any one particular part for the preservation of another. Military authorities have stressed that forthcoming training operations in this area must be conducted free from off-limit zones or other non-strategic barriers to ensure successful accomplishment of the National Training Center's mission.

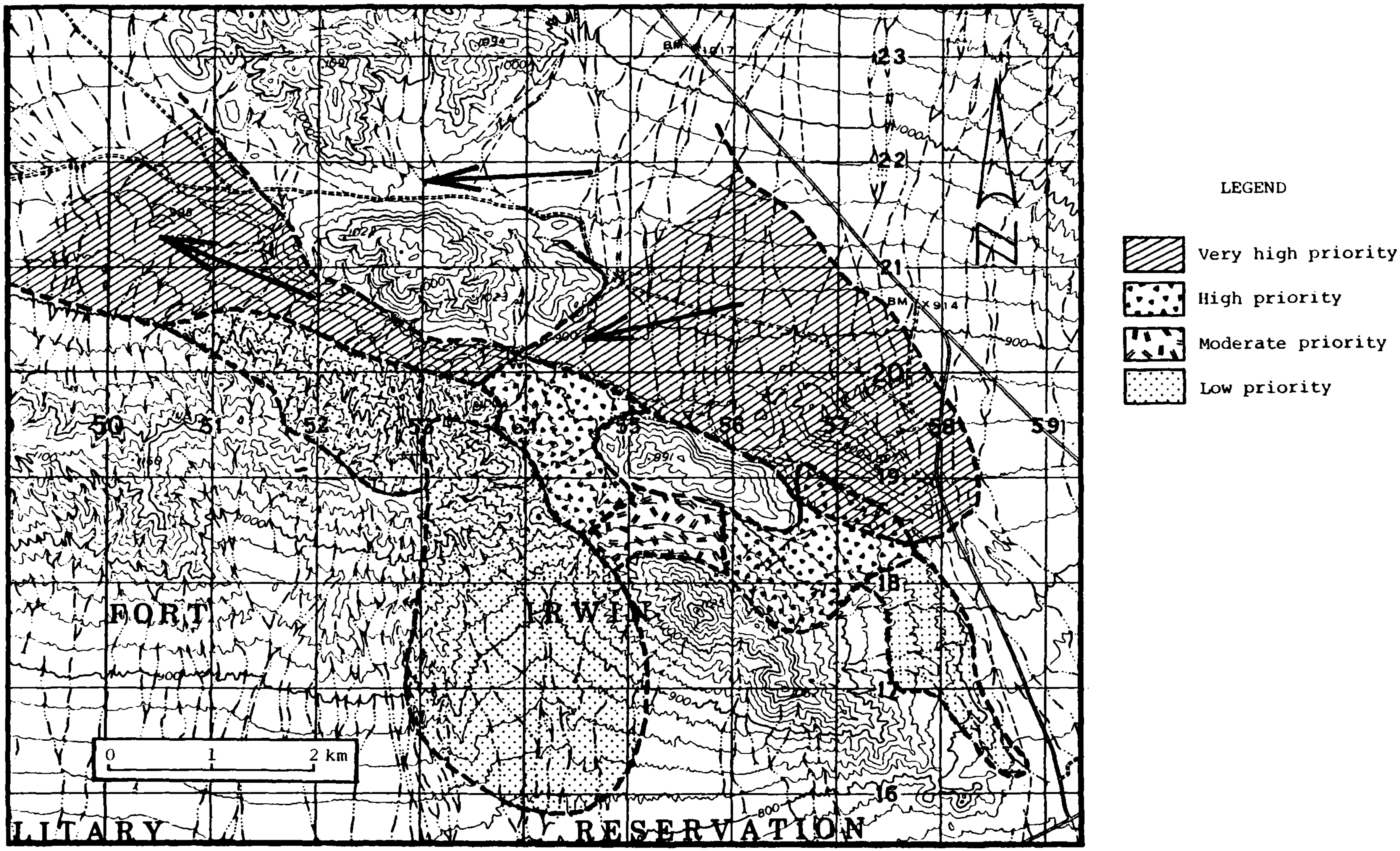


Figure 29

This figure illustrates a generalized hierarchy of priority use areas defined by military planners. The information was presented by the U.S. Army to the Interagency Archeological Services Division to emphasize the importance of this sub-region to the successful completion of the forthcoming training operations (Dean 1981:personal communication).

From the total inventory, fourteen resource sites are recommended as eligible for inclusion to the National Register of Historic Places. Three of these (4-SBr-4204, -4249, and -4515) are major float lithic resource quarry areas that appear to warrant consideration as a discontiguous district, owing to their valuable integrity, large and diverse content, and high potential to yield information important to the prehistory of the northwestern Mojave Desert region. The eleven other resources (4-SBr-4729, -4730, -4732, -4733, -4734, -4735, -4736, -4744, -4746, -4749, and -4751) recommended eligible include small- to medium-size flake scatters, core reduction stations, rock rings, and a large site complex comprised of loci representing numerous activity zones. The remainder have been rated as of questionable quality, and some may or may not warrant further examination and study.

The discontiguous district recommended here would accomplish several valuable measures. Although each resource is of excellent individual character, collectively their values are significantly increased. Reasons for consideration of a discontiguous district include, but are not limited to, the following:

1. A major class of site type, float lithic resource quarry, has been identified and subjected to detailed documentation. Three of these sites discovered to possess high integrity and known to contain broad variability in both inter- and intra-site perspectives would be considered collectively in future aspects of planning, investigation, and study.

2. Continued study and interpretation of flaked stone tool procurement, manufacture, and use require a large sample universe for refinement of analyses capable of determining style, method, purpose (or function), and chronological ordering of stone tool technologies. Consideration of these float lithic resource quarries in a collective manner rather than as individual properties heightens the potential for accurately perceiving variation between and within each site.

3. Cultural resource assessments in the northwestern Mojave Desert (particularly within the reservation boundaries) have shown that for perhaps the past twelve to fifteen thousand years, the region has been intensively used and exploited by indigenous populations. The float lithic resource quarry sites have among them greater probability of containing important data that spans the full temporal cultural period and, together, possess a significant concentration linked closely to the lives and requirements of early North American Indian peoples.

Perhaps the most significant measure deriving from acceptance of the recommendation for a discontiguous district is that

compliance with applicable federal standards will proceed in an efficient and practical manner, ensuring that the National Training Center program contributes to the preservation and enhancement of significant archaeological discoveries for the inspiration and benefit of the citizens of the United States.

The remaining eleven resource sites recommended as eligible for the National Register are submitted as individual sites. Although they may be related temporally or culturally to either the float lithic resource quarries or to each other, questions of contemporaneity have not been adequately addressed at this level of assessment. It must remain for future researchers to address the questions of interrelationships and associations among the total resource inventory.

Cornerstone Research recommends that the above-listed cultural sites be evaluated for eligibility, based on the enclosed inventory data and additional documentation, and nominated for inclusion to the National Register of Historic Places. Cornerstone Research also recommends a resource conservation approach through area avoidance; however, national security requirements are such that this area will probably be required for training programs in the near future. Therefore, a detailed and comprehensive research design should be formulated and operationalized. The "strong inference" research method (Platt 1964) is recommended to accomplish a multiple-phase, problem-oriented data recovery program. This formal theory and hypothesis testing recovery plan should include, but not be limited to, further refinement of provisional artifact types assessment to culminate in formally devised and anthropologically sound cultural types (Krieger 1944; Kluckhohn n.d.). Further, emphasis should be added to the various divisions of core reduction stations and core configurations. This should assist in differentiating numerous subdivisions of temporally distinctive and technologically specific activity sets.

Additional data recovery or documentation may be necessary to clarify potential interrelationships between the various light- and medium-density activity centers and the isolated finds. Each of these items should be considered potentially associated with other resource zones in terms of a diverse area exploitation pattern and should be protected from impacts until determinations of eligibilty have been verified.

If adverse impacts cannot be avoided, implementation of a comprehensive research plan as described above should be conducted to alleviate or mitigate the effects of such loss of the cultural and scientific resources.

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APPENDIX A

Locational Data

Locational data and maps are on file with the Interagency Archeological Services Division-San Francisco.

APPENDIX B

Documentation Systems

State of California - The Resources Agency
Department of Parks and Recreation
ARCHAEOLOGICAL SITE SURVEY RECORD

Site No.________

1. Previous Site Designation________ 2. Temporary Field No.________

3. USGS Quad________ 7.5'____ 15'____ Year________

4. UTM Coordinates________

5. Twp.________ Range________: ____qtr. of ____qtr. of Sec.____

6. Location:________

7. Contour________ 8. Owner & Address________

9. Prehistoric____ Ethnographic____ Historic____ 10. Site Description________

11. Area____x____meters; ____square meters 12. Depth of Midden________

13. Site Vegetation________ Surrounding Vegetation________

14. Location & Proximity of Water________

15. Site Soil________ Surrounding Soil________

16. Previous Excavation________

17. Site Disturbance________

18. Destruction Possibility________

19. Features________

20. Burials________

21. Artifacts________

22. Faunal Remains________

23. Comments:________

24. Accession No.________ 25. Sketch Map________ by________ where________
26. Date Recorded________ 27. Recorded by________
28. Photo Roll No.________ Frame No.________ Film Type(s)________ Taken By________

DPR 422 (Rev. 9/76)

ARCHAEOLOGICAL SITE DATA - SHORT FORM

Site No.______________ Field No.______________ Date______________

Project____________________ Supervisor/Recorder____________________

Quad____________________ UTM Coordinates____________________

Site Description/Location____

Site Dimensions____________________ Culture Pattern____________________

Artifacts____

Ecofacts____________________ Features____________________

Disturbance____

Soil Type and Color____

Geology /_/Salt Pan /_/Playa /_/Active Fan /_/Stable Fan

/_/Active Dunes /_/Stable Dunes /_/Fossil Dunes /_/Sheet Sand

Other____

Local Water Sources /_/Spring /_/Permanent Drainage /_/Seasonal Drainage /_/Seeps

Other____

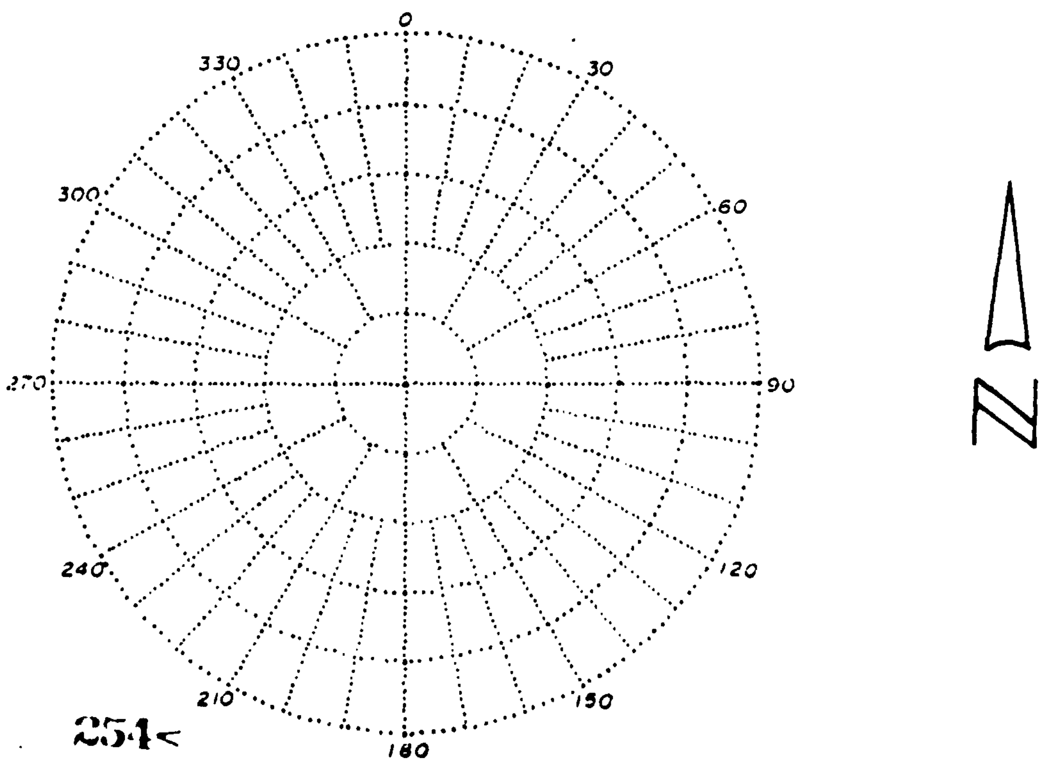
Flora/Fauna____

Elevation____________________ Reference Bearings____________________

Remarks____

Drawings/Photos____

Sketch Map: Scale: 1 cm = ______________ meters



ARCHAEOLOGICAL EXCAVATION
PLOT SHEET

Organization: ____________________ Site No. __________

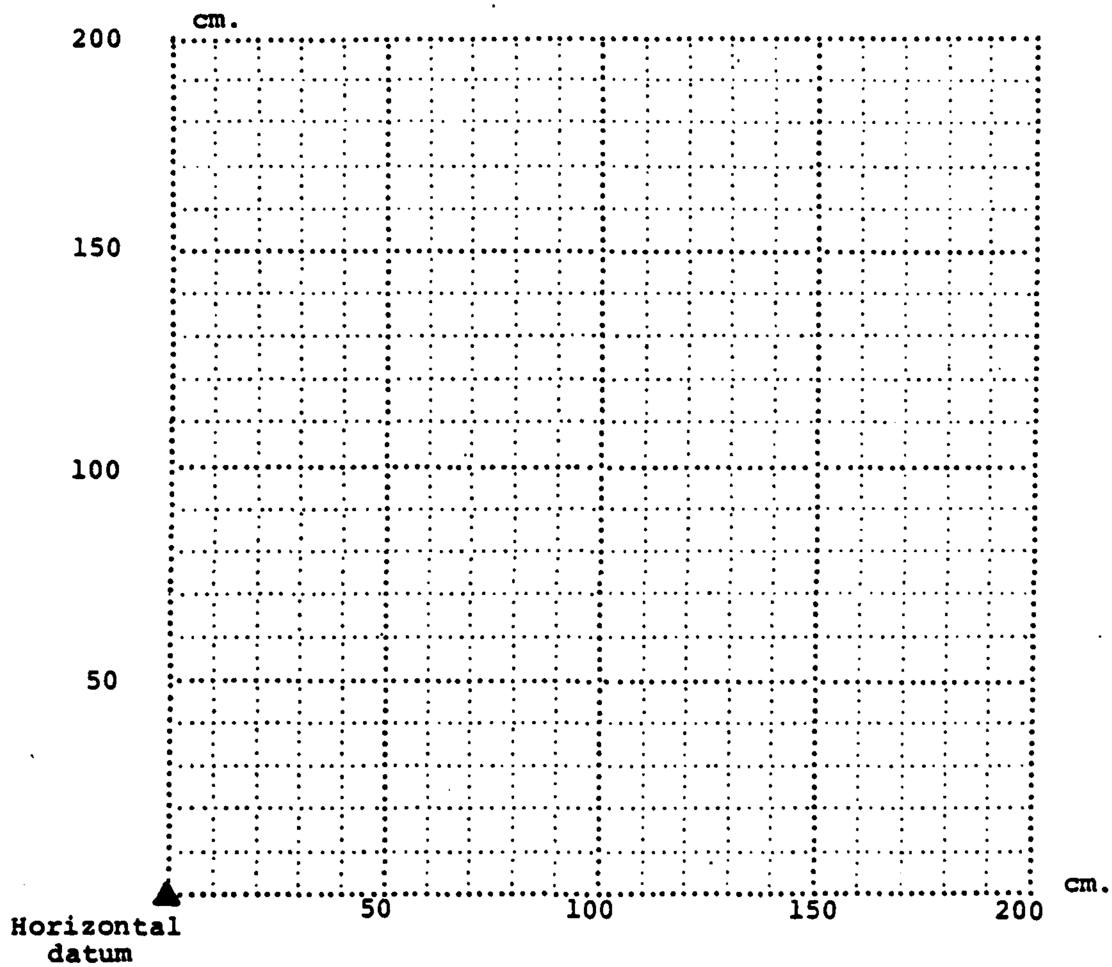
Project: ____________________ Unit No. __________

Recorder/Excavator: ____________________ Level __________

Supervisor: ____________________ Date __________

Vertical Datum __________

Indicate clearly cultural and physiographic features below:



SUGGESTED SYMBOLS

HS	Hammerstone	Ⓝ	Natural Stone
Ⓒ	Core	P	Potsherd
F	Flake	S	Shell
●	Debitage	O	Osteological Remains
T	Undesignated Tools	*	Charcoal
MET	Metate		Ash Traces (or extensive charcoal)
Ⓜ	Mano		Rodent Activity
⊗	Cobble	△	Depth from Vertical Datum
Ⓗ	Thermal Fractured Rock add *f.* for fragments		Add others as necessary

ARCHAEOLOGICAL EXCAVATION LEVEL SHEET

Organization: ______________________________ Site No.: ____________________

Project: ______________________________ Unit No.: ____________________

Recorder/Excavator: ______________________________ Level: ____________________

Supervisor: ______________________________ Vertical Datum: ____________________

Date Begun: ______________________________

Date Completed: ______________________________

General Level Information: (excavation methods, progress, etc.) ____________________

Soil Description: (compactness, consistency, etc.) ____________________

SOIL SAMPLE

Disturbance Noted: (animal burrows, roots, etc.) ____________________

Cultural Material located in situ: (measurements in centimeters)

Item No.	East	North	Depth	Description of Item

Feature Descriptions: ____________________

Additional Observations, Comments, and Discussion: ____________________

Additional Information Sheet Attached? ______ Plot Sheet Attached? ______

ARCHAEOLOGICAL EXCAVATION FIELD OBSERVATIONS
STRATIGRAPHIC PROFILE SKETCH SHEET

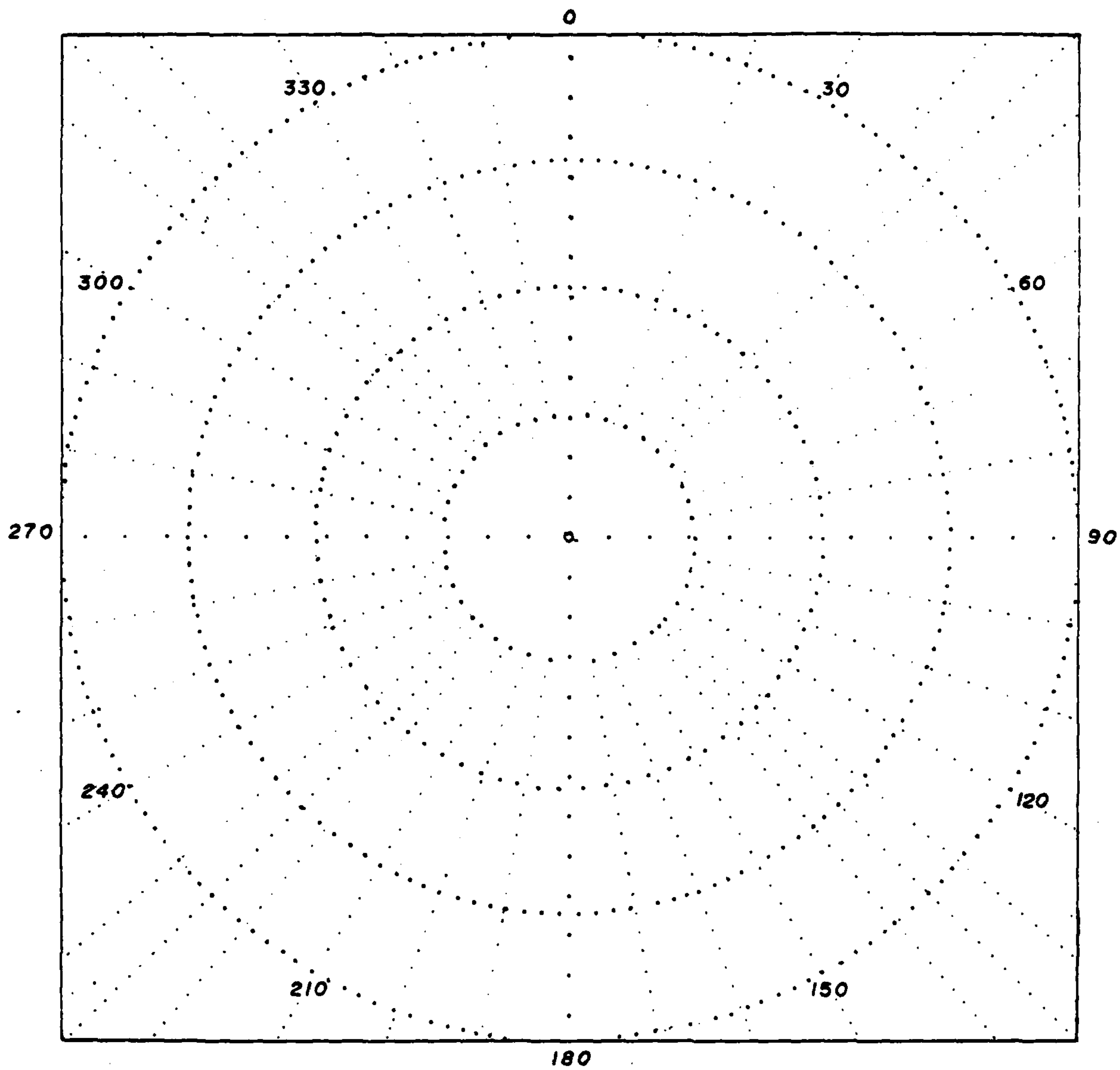
Organization: ____________________ Site No.: ____________
Project: ________________________ Unit No.: ____________
Recorder: _______________________ Profile: _____________
Supervisor: _____________________ Date: ________________

ARCHAEOLOGICAL SURVEY FIELD OBSERVATIONS
SITE SKETCH MAP

Organization: ______________________________
Project: ______________________________
Supervisor: ______________________________
Recorder: ______________________________

Tentative
Site No.: ____________
Date: ____________
Indicate scale used:
2cm.= ____________ m

Indicate cultural and physiographic features below:



List Symbols Used:

Additional observations, sketches, and comments on reverse: _____Yes _____No

PHOTOGRAPH LOG

Organization______________________________ Date____________________

Project__________________________________ Site #(s)_________________

Supervisor/Recorder____

Camera #_________________________________ Roll #___________________

Film Type/ASA____________________________ Lens_____________________

CORNERSTONE RESEARCH

PROJECT ______________________

SITE # ______________________

DATE ______________________

CAMERA/ROLL ______________________

SUBJECT ______________________

____

OBSERVATION CODES

Administrative Code

1=Survey (isolates)
2=Posthole Test Series
3=Limited Unit Series
4=First Phase Test Series
5=Second Phase Test Series
6=Stratigraphic Profile Trench/Unit
7=Micromap Recovery/Surface Scrape

Condition Code
Striking Platform/Contact Area

0=Not Observed
1=Conical
2=Crushed *(subangular)*
3=Shattered (angular)
4=Obliterated
5=Dissected

Platform Preparation Code

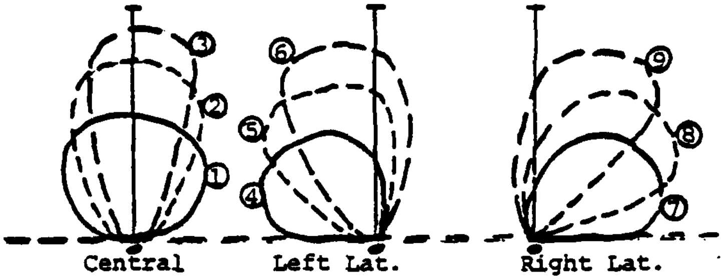
0=Not Observed
1=Grinding
2=Sanding
3-Polishing
4=Edge Turning (dorsal side)

Core Patterning Code

1=Amorphous (residual)
2=Sinuous (crested)
3=Serrated (denticulated)
4=Uni-directional
5=*Bi-directional*
6=Multi-directional

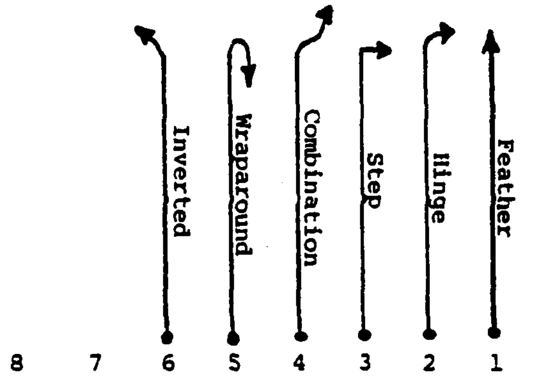
PRELIMINARY

Mass Form Code (generalized)



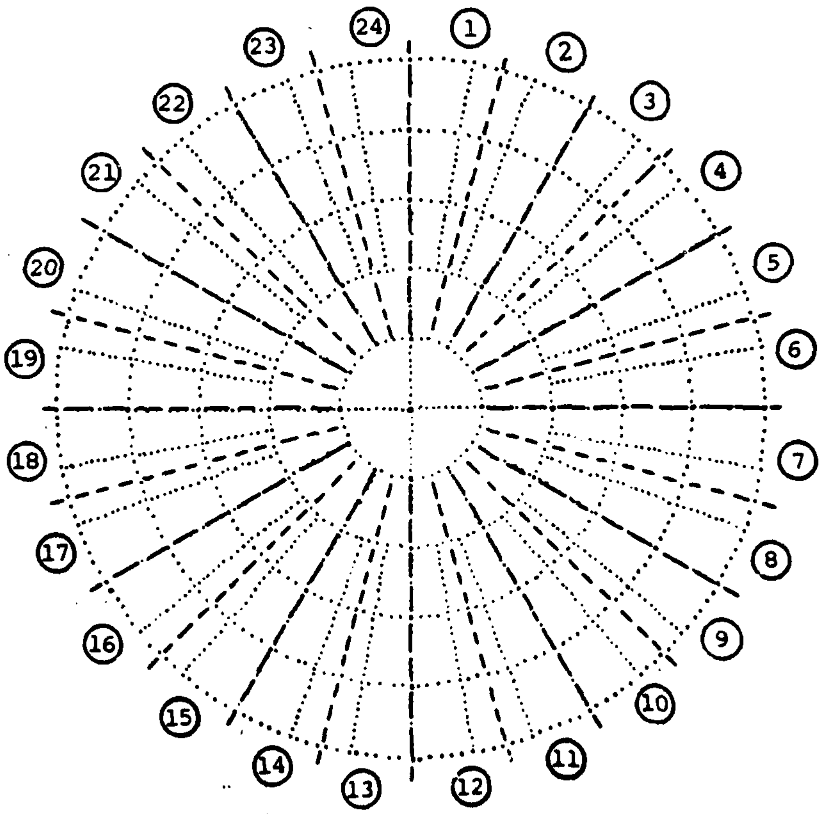
(Viewed from ventral face)

Termination Code



(viewed with ventral side to left)

Polar Reference Code



(Determined from dorsal face centered with platform to bottom)

FLAKE OBSERVATIONS

Organization________________________ Station Number______________

Project________________________ Processing Dates______________

Site Number________________________ Recorder______________

Catalog No. /_/_/_/_/ 1 2 3 4

Class Code /_/_/ 5 6

Admin. Code /_/ 7

Provenience Code /E/_/_/_/_/N/_/_/_/_/ 8 9 10 11 12 13 14 15

Depth Code /_/_/_/ 16 17 18

Study Segment /_/_/ 19 20

/_/ 21 1=in situ 2=dislocated

Length (cm) /_/_/_/ 22 23 24

Width (cm) /_/_/_/ 25 26 27

Thickness (cm) /_/_/_/ 28 29 30

Weight (gm) /_/_/_/_/_/ 31 32 33 34 35

Lithic Material /_/_/ 36 37

VENTRAL FACE

Striking Platform

Thickness (mm) /_/_/_/ 38 39 40

Width (mm) /_/_/_/ 41 42 43

Condition /_/ 44

Fabricator Contact Area

Length (mm) /_/_/_/ 45 46 47

Width (mm) /_/_/_/ 48 49 50

Condition /_/ 51

Eraillure

Length (mm) /_/_/_/ 52 53 54

Width (mm) /_/_/_/ 55 56 57

Termination /_/ 58

/_/ 59 Platform Preparation

/_/ 60 Mass Form Code

/_/ 61 Distal Termination

/_/ 62 Compression Rings

/_/ 63 Fissures

/_/ 64 Bulb of Applied Force

(62–64) 0=no 1=yes

/_/ 65 Iron Oxide

/_/ 66 Manganese Oxide

/_/ 67 Patination

(65–67) 0=none 1=light 2=medium 3=heavy

DORSAL FACE

Cortex Percentage /_/_/_/ 68 69 70

Previous Flake Removals

	Polar Reference	Termination Code
1	/_/_/ 71 72	/_/ 73
2	/_/_/ 74 75	/_/ 76
3	/_/_/ 77 78	/_/ 79
4	/_/_/ 80 81	/_/ 82
5	/_/_/ 83 84	/_/ 85

/_/ 86 Dissections 0=not observed 1=mesial 2=medial 3=transverse

/_/ 87 Iron Oxide

/_/ 88 Manganese Oxide

/_/ 89 Patination

(87–89) 0=none 1=light 2=medium 3=heavy

/_/ 90 Meniscus Lens 0=no 1=yes

/_/ 91 Natural Cracks/Facets 0=no 1=yes

/_/_/ 92 93 Total Flake Removals

CORE OBSERVATIONS

Organization________________________ Station Number________________

Project________________________ Processing Dates________________

Site Number________________________ Recorder________________

Catalog No.	Class Code	Admin. Code	Provenience Code	Depth Code
/_/_/_/_/	/_/_/	/_/	/E/_/_/_/_/N/_/_/_/_/	/_/_/_/
1 2 3 4	5 6	7	8 9 10 11 12 13 14 15	16 17 18

Study Segment	1=in situ 2=dislocated	Length (cm)	Width (cm)	Thickness (cm)	Weight (gm)
/_/_/	/_/	/_/_/._/	/_/_/._/	/_/_/._/	/_/_/_/_/._/
19 20	21	22 23 24	25 26 27	28 29 30	31 32 33 34 35

Lithic Material

/_/_/

36 37

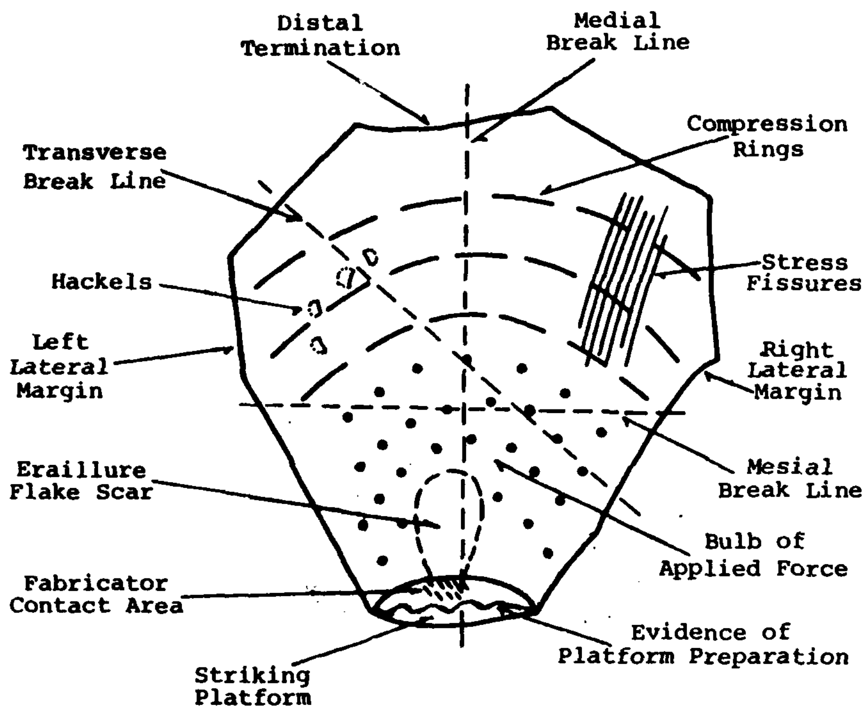
0=none, 1=light, 2=medium, 3-heavy

Total Flake Removals	Cortex Percentage	Iron Oxide	Manganese Oxide	Patination	Patterning Code
/_/_/_/	/_/_/	/_/	/_/	/_/	/_/_/
38 39 40	41 42	43	44	45	46 47

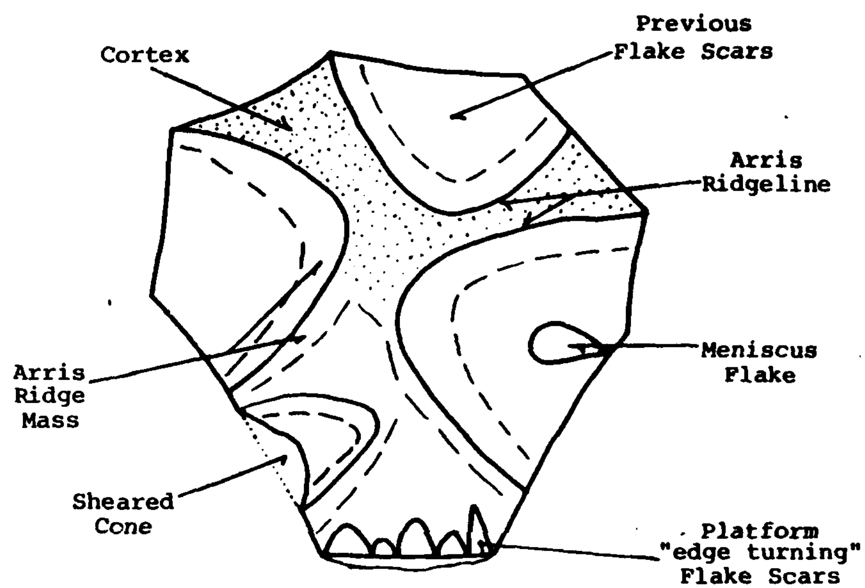
Predominant Five Flake Removals

0=no, 1=yes

	Platform Preparation	Termination	Compression Rings	Fissures	Bulb of Applied Force	Meniscus Lens	Natural Cracks/ Facets
1	/_/ 48	/_/ 49	/_/ 50	/_/ 51	/_/ 52	/_/ 53	/_/ 54
2	/_/ 55	/_/ 56	/_/ 57	/_/ 58	/_/ 59	/_/ 60	/_/ 61
3	/_/ 62	/_/ 63	/_/ 64	/_/ 65	/_/ 66	/_/ 67	/_/ 68
4	/_/ 69	/_/ 70	/_/ 71	/_/ 72	/_/ 73	/_/ 74	/_/ 75
5	/_/ 76	/_/ 77	/_/ 78	/_/ 79	/_/ 80	/_/ 81	/_/ 82



Ventral Side



Dorsal Side

Stylistic Representation of Flaked Lithic Nomenclature

ARCHAEOLOGICAL SITE EVALUATION CRITERIA

The following evaluation criteria were formulated by a task force which included representatives from the archaeological community (professional, avocational, and academic), construction industry, Native American groups, and administrative or governmental agencies. These criteria are currently under review by the County of San Diego Environmental Analysis Division for eventual adoption.

Criterion #1: Integrity

A site which is physically intact, in whole or in part, and is reasonably similar to its condition when last used by the aboriginal culture is said to have maintained its optimum integrity. This criterion also includes integrity of the environmental setting in the vicinity of the site.

Ratings for Integrity Category

1 = lack of context of artifacts
9 = no damage by human agency, but natural agency may have caused damage
10 = no disturbance, either by natural or human agency

An Example

Pothunting obviously disturbs the physical integrity of a site. Therefore, if 10 percent of the defined surface midden area of a site has been pothunted, one point is lost on the integrity scale; if 20 percent has been pothunted, two points are lost, and so on.

Criterion #2: Regional Aspects

A site (or system of sites) which is unique to its physical setting as the only or one of the few sites representative of a particular site type in a particular locale, an area where site attrition is high, an area where the resource base is scarce, or a site which does not fit into the generally accepted pattern for that site type would be recognized as a site which rates high on the regional aspects scale.

Ratings for Regional Aspects Category

1 = area where there is a well-established resource base, a site which does fit into the general pattern, or an area where site attrition is low
10 = area where there is a poorly established resource base, a site which does not fit into the general pattern, or an area where site attrition is high

Criterion #3: Variability of the Resource

This category includes the following aspects of a site: variety, quantity, and depth. It also includes multi- and single-component sites. Variety means a site which contains a full range of representative artifacts or features. Quantity means a site which possesses a high range of frequency and density of cultural remains. Depth refers to a distinctive stratigraphic record, which most often indicates a longer period of occupation.

Ratings of Variability of the Resource Category

1 - 10 = a site which has no midden depth, a small quantity of artifacts, and a homogeneity of cultural debris, to the complete opposite condition

Criterion #4: Ethnic Value

A site or general area which has special significance to a Native American group, for whatever reason, is said to have ethnic value. This should be evaluated by representatives from the local Native American population, by special arrangement. If for some reason Native Americans fail to respond, this category will have to be evaluated by the consulting archaeologist.

Ratings for Ethnic Value Category

0 = no ethnic value
10 = significant ethnic value (Provide an explanation of the rationale, including a Native American observer's statement.)

Criterion #5: Site Type Represented

Certain sites contain features which may be of interpretive and/or educational value to the general public. A site with milling features, rock-walled structures, pictographs, petroglyphs, or a historical structure are examples of such sites. These could be incorporated into outdoor museums or into open space parks for public use. A site may also have aesthetic significance according to the values of the individual citizen.

Ratings for Site Type Represented Category

0 = site possesses no interpretive or educational features
10 = site possesses substantial interpretive or educational features

Criterion #6: Research Potential

On the basis of surface artifacts and/or subsurface testing procedures, the opportunity for scientific study of a particular aspect of the cultural process indicates a site's research potential. Sites which represent new insights into any number of research questions would rank high on this scale. The following are suggested areas in which potential studies can be made:

1. settlement pattern analyses
2. pollen analyses
3. radiometric studies
4. ecofactual analyses
   a. ethnobotanical studies
   b. faunal studies
5. ceramic studies
6. lithic studies
7. unique features or artifacts
8. systemic context
9. chemical studies
10. obsidian hydration studies
11. rock art studies
12. subsistence pattern analysis
13. resource exploitation patterns
14. transportation and trade systems
15. other
16. informant/documentary evidence
17. social organization/patterns
18. ritual behavior
19. geological associates
20. widespread regional value

GUIDELINES FOR THE DESIGNATION OF SITE/ISOLATE

The following guidelines have been prepared to aid in differentiating Sites from Isolates in order to accurately record the location of and to recover information from archeological resources. Following Barker, Rector and Wilke (1979) and Hanna (personal communication) a Site is defined as the remains of focused past human activity while an Isolate is an item or items dropped or discarded with no evident, specific relationship to a site.

Designation

To aid in the identification of a site, four criteria will be utilized:

1) Midden: Midden should be discernible, with evidence including unnaturally darkened soils, abnormally organic-rich soils, ash or charcoal-laden soils, cultural subsurface items, or recognizable vertical cultural stratigraphy.

2) Multiple Class Artifacts/Density: At least three classes of artifacts must be evident, as: flakes/debitage, cores, utilized flakes, flaked lithic tools (including points), ceramics, milling implements (including handstones and metates), bone or wood implements, decorative items (shell or stone beads, pendants, etc.), and such cultural ecofacts as shell or modified bone. (Historic artifacts are included; however, specific definition is felt to be unnecessary). At least 20 items within a 10 m radius are required unless there is special and explicit justification for a lesser density.

3) Significant Features: Included are hearths, structural remains, rock rings, alignments and cleared circles, trails, groupings of metates or mortars, intaglios, rock art, inhumations or cremations and non-portable items. Historic features, such as corrals, cisterns, wells, improved or enhanced springs, mines or structure foundations are also included.

4) Area/Density: Twenty or more cultural items within a 10 m radius, of whatever artifact class, are included.

Should one or more of the criteria be identified, the resource will be designated a Site. If one or more Sites are designated in close proximity and appear to be loci within a greater site, they may be designated as Loci within a greater Site. The Loci/Site designation should be thoroughly justified and each Loci described in the Site documentation.

Should none of the criteria be met, and the resource contain fewer than 30 items within a 20 m radius, the resource will be designated an Isolate. If, however, no criteria are met, yet the resource is found to contain greater or equal to 30 items within a 20 m radius, the resource will be designated as a Cluster and is subjected to further definition. No collection will be undertaken until additional survey of the vicinity is completed.

If one or more Clusters are located within 30 m of the Cluster's outer boundary, the Clusters are designated a Site. In this case, it will be necessary to decide if the Clusters should be designated as Loci/Site or as more than one Site.

Documentation

A precise, accurate map/aerial photograph plot of each resource will be made to aid in the determination of Site or Isolate designation. Once the designation has been made, the following actions will be taken:

Isolate

1) A short form record will be filled out completely.

2) In addition to the plotted map/photo location, an accurate map of the resource will be made which records the precise provenience of each diagnostic or unique item and delimits the areas of concentration of flakes/debitage or other cultural items.

3) Following their precise location on the map, the diagnostic or unique items only will be collected.

Site

1) An official State of California site form will be completely filled out and an official trinomial site designation obtained as soon as possible.

2) In addition to the plotted map/photo location, an accurate, detailed site map will be made with specific attention to establishing and recording the site boundaries.

3) Sufficient information will be secured to provide for an evaluation of significance and the process of Determination of Eligibility for the National Register of Historic Places.

4) Photographs of the Site will be taken at this time.

5) No collection should be undertaken unless specific instructions to do so are secured from the COAR or his authorized representative. In the event that collection is authorized, accurate proveniences will be recorded for all collected items.

A flow chart of the described guidelines is attached.

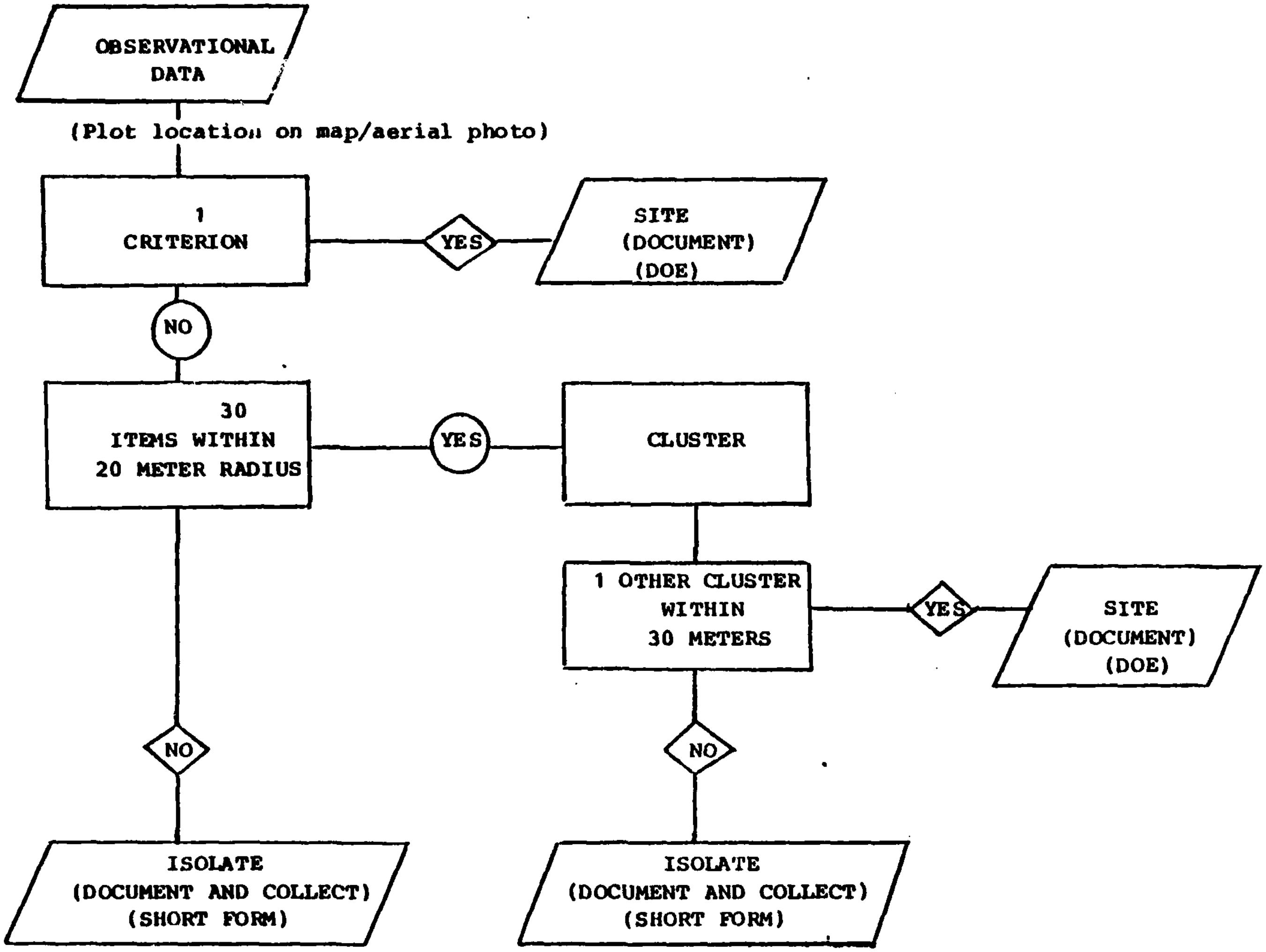


Figure One - Flow Chart for definition, documentation and collection of archeological resources. (After Hanna; revised by Dean)

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